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ENVIRONMENTAL QUALITY

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WORLDWIDE REPORT ENVIRONMENTAL QUALITY

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INTER-ASIAN AFFAIRS

BRIEFS

MALACCA STRAIT ANTIPOLLUTION FUND--Indonesia, Malaysia, Singapore and Japan on 11 February in Jakarta signed a memorandum of understanding on the setting up of a 400 million yen fund for the prevention of pollution of the Malacca Strait. Japan will contribute 300 million yen and Indonesia, Malaysia and Singapore 100 million yen. The management of the fund will be rotated every 5 years between Indonesia, Singapore and Malaysia. [Jakarta Domestic Service in Indonesian 1500 GMT 11 Feb 81 BK]

CSO: 5000

DROUGHT BRINGS FORECAST OF LOWER CROP YIELDS

Canberra THE FINANCIAL AUSTRALIAN in English 22 Jan 81 p 1

[Text]

WIDESPREAD drought has slashed \$600 million from rural output this year, according to the Bureau of Agricultural Economics.

Hardest hit will be crops — particularly wheat where production is expected to fall 33 per cent.

The 1980-81 forecasts for Australia's biggest single export industry were released yesterday by the bureau.

One of the few bright points in the report was that higher prices for primary products, at home and abroad, would help offset falls in output.

The net value of rural output was expected to be \$4600 million — about \$600 million or 12 per cent less than last season.

The bureau estimates that, with inflation running at 10.5 per cent, the real net value of rural production will be 30 per cent lower than 1979-80.

Gross return to farmers should be \$11.870 million and

farm costs are estimated to rise 9.2 per cent.

But the value of rural exports — about 45 per cent of all Australian exports — is expected to rise about 3.7 per cent to \$8790 million, despite a 12 per cent fall in the volume of exports.

The gross value of wheat production is estimated at \$1785 million, well below the record levels of the past two seasons.

A record 11.5 million ha was sown for wheat last year, but yields have been well down in Queensland, northern NSW and Western Australia.

Overall output is estimated at 10.8 million tonnes — 5.2 million tonnes less than last season.

Although the wool clip will also be smaller this year because the drought has reduced lambings and meant high sheep disposal rates, better prices have raised the overall value marginally.

The clip is expected to be worth \$1855 million which

will bring in \$1810 million in 1980-81 exports, including the carry over from last season.

Production of beef and veal is expected to drop 2 per cent, to a total of \$2680 million.

But better export prices for beef, particularly in the US, will mean a 6 per cent rise to \$1280 million.

The bureau has anticipated normal trade with the Middle East this year.

As a result, it expects 5.8 million live sheep to be shipped to that region. This trade will be worth \$180 million.

Other rural highlights for 1980-81 include:

● **DAIRY** output should rise about 11 per cent to \$755 million.

● **SUGAR** output is expected to reach a record \$815 million, over 50 per cent higher than last year.

● **FRUIT** should fall about 2 per cent, with the overall crop valued at \$548 million.

CSO: 5400

GUANGDONG REGULATIONS PROVIDE FOR ENVIRONMENTAL FUNDING

Guangzhou NANFANG RIBAO in Chinese 30 Nov 80 p 1

[Article by Huang Zhimin [7806 2535 3046] and He Shaoying [0149 1421 5391]:
"Provincial People's Government Issues Regulation: There is Now a Source for
Environmental Protection Funds"]

[Text] Recently, the provincial people's government issued a regulation on
strengthening environmental protection work, clarifying the source of funds for
pollution control.

In the past few years, Guangdong Province has had some success in environmental
protection work, but because the law was new, because control was not strict,
and because measures were not forceful, it was impossible to control environmental
pollution. focusing on this situation, the provincial people's government
recently issued a regulation on strengthening environmental protection work.
The regulation stipulates:

When enacting national economic development plans, the people's government and all
concerned departments should make environmental protection a part of national
economic planning. To conscientiously carry out "three simultaneous" regulations
while preventing the occurrence of new sources of pollution, the question of "three
waste" pollution by old enterprises should be resolved in stages. Beginning next
year, each year about 5 percent of gross capital investment funds can be used
for environmental protection projects in order to resolve prominent pollution
problems. About 20 percent of the replacement and rebuilding funds in the fixed
assets controlled at each level can be used for environmental protection.
Within the next 3 years, 2-3 percent of the industrial scientific research
expenses can be used for environmental protection research projects. Control
of the "three wastes" should have priority in the replacement and rebuilding
funds of fixed assets retained by enterprises. The portion of the multipurpose
use profit retained [to combat the] "three wastes" should be guaranteed for use
in controlling pollution. A fair portion of enterprise capital funds should be
used for environmental protection. Small loans can be requested for some control
projects.

8226

CSO: 5000

CENTRAL COMMITTEE PROPOSALS REDUCE POLLUTION IN BEIJING

Beijing BEIJING RIBAO in Chinese 15 Jan 81 p 1

[Article by Qing Yuan [3237 3293]: "Conscientiously Carrying Out the Central Committee's Proposals on Environmental Protection Brings Results; Last Year Beijing Completed One Group of 'Three Wastes' Control Projects"]

[Text] Last year Beijing completed a group of "three wastes" control projects and made new advances in environmental monitoring and research. Environmental pollution is still very serious, however, and control must be further strengthened.

Last year, in order to thoroughly implement the Central Committee's four-point proposal on the direction of municipal work, concerned municipal departments enacted a long-range plan for environmental protection in Beijing and clarified the goals and focal points for control. This year a total of 19 major control projects were completed, 17 of which had time limits imposed by the State Council and municipal government. Concerned departments also used technical reform funds to complete over 100 control projects. Completion of these control projects reduced the pollution of the city's environment by poisonous and harmful substances. According to the results of monitoring by concerned departments: at present, pollution of surface water by arsenic, phenol and cyanogens has already been reduced; the area of ground water polluted by phenol and cyanogens in the western suburbs has been reduced somewhat. Last year, the city concentrated on rebuilding boilers to control atmospheric pollution. In the past year, nearly 1,000 boilers have been improved, so that about 85 percent of the boilers in the city and inner suburban area neighborhoods have been rebuilt, and the overwhelming majority no longer give off black smoke. The annual savings in coal was 30,000 tons, which reduced by 600 tons the carbon dioxide emitted into the atmosphere. Last year the city changed production or moved out of the city some factories and machine shops which were situated in densely populated residential areas and whose noise seriously disturbed the local residents. Fifty-three coal company machines that make honeycomb briquets in the city and which seriously disturbed the people were brought under control. In this way, the noise pollution situation in some parts of the city was improved.

Last year, at the same time that work began on controlling environmental pollution, the city also actively began scientific research and monitoring of the environment. Sixteen important scientific research projects were completed during the year by

Beijing's Institute for Scientific Research on Environmental Protection alone, including research on survey, prevention, and control of environmental pollution in Beijing's southeastern suburbs; research and development of a polyphthalamide permeation-proof membrane and its application on wastewater from chrome-plating baths; the present situation, developments, trends, and ways of controlling sulphur dioxide pollution created by use of coal and fuel oil in Beijing; the effects of Co-60 gamma rays on hospital sewage; and disinfection of sludge. Last year, with the help of concerned departments, the Municipal Environmental Protection Monitoring Center acquired 260,000 items of monitoring data which supplied materials for scientific research and control of the city's environmental protection.

Environmental pollution in Beijing is still very serious. Last year, the Municipal Environmental Protection Bureau conducted a spot-check of 100 capital construction projects and 700 technological reform projects and discovered that one-third had not carried out the "three simultaneous" provisions. There are a great many factories whose industrial "three wastes" exceed national standards and which even today have not taken any effective measures to control them. The hardness and nitrate content of ground water continues to increase. Although we rebuilt boilers in the past, because the quantity of coal burned continues to increase and measures to control pollution from automobile exhausts have been lacking, atmospheric pollution is still severe and will require considerable effort before it can gradually be resolved.

Recently, concerned departments in the city figured that municipal environmental protection work this year would have to strengthen environmental management and promote control through management. Emphasis was placed on doing a good job of controlling the "three wastes" within the 62-square-kilometer city center and checking on "three simultaneous" in new, expanded, and rebuilt construction in order to prevent the creation of new sources of pollution.

8226

CSO: 5000

METHODS FOR RIDDING WASTE WATER OF DDT DISCUSSED

Beijing HUANJING KEXUE [ENVIRONMENTAL SCIENCE] in Chinese Vol 1 No 6, 30 Dec 80
pp 1-5

[Article by Tang Guichun [0781 2710 2504], Wang Jusi [3769 5468 1835], Zhao Lihui [6392 7787 6540], Wang Dasheng [3769 1129 3932] and Tong Yuqin [0157 3768 5367]*, Institute of Environmental Chemistry, Chinese Academy of Sciences, "Research on DDT Removal in Pesticide Waste Water"]

[Text] DDT is a highly toxic, highly persistent organic chlorine, which can pass through the food chain and concentrate in the bodies of animals and humans. For this reason, numerous countries have proscribed or limited its use, at the same time undertaking research in treatment techniques. In recent years, China has deemed treatment of organic chlorine agricultural chemical waste water an important problem. We have worked together on waste water produced by the DDT production shop of the Tianjin Chemical Plant in research using metallic pair reduction to eliminate DDT.

This research included preparation of metallic pair catalysts, testing of activity of the catalysts, and exploration of the apparent dynamics of metallic pair catalytic reduction of DDT.

I. Preparation of Metallic Pairs

In the case of copper and iron metallic pairs, acetone was placed in a three-neck flask, which was placed in a 50°C constant temperature bath. Powdered iron was placed in suspension in the acetone and, while stirring constantly, a 2 percent aqueous solution of cupric sulfate was added drop by drop, causing the copper to precipitate to the surface, thus forming metallic pairs.^{1,2}

Under ordinary conditions, the weight ratio of iron powder and acetone is 1:4 in iron and copper of 1 gram to 1 milligram equivalent.

*This research work was conducted under the guidance of Comrade Hu Keyuan [5170 0460 3293]. Comrades Chu Jianjun [0443 1696 6511], Wedeqin [3306 1795 0530], Zhao Qingji [6392 1987 7535], Sun Jianhua [1327 1696 5478], Zhu Tianhe [4281 1131 0735], and Ye Ronghua [0673 5554 5478] also participated in some of the research work. The medium size experiment was conducted at the Tianjin Chemical Plant, whose main laboratory gave its vigorous support and participated in the experiment.

Selection for the experiment of other reaction conditions included:

1. Selection of Reaction Temperature

Preparation of the metallic pairs was done at a constant temperature of about 20°C. The reaction proceeded very slowly and the copper seemed to plate to the iron quite poorly. When operating temperatures were too high, the acetone swirled fiercely (acetone's boiling point is 56.5°C), which might cause excessive loss of acetone and increase the danger of the process. Consequently a reaction temperature of about 50°C was selected.

2. Selection of Medium

We tried out water, ethyl alcohol, and acetone as mediums in the preparation of the metallic pairs. Results were poor from the use of water as a medium with the copper refusing to plate to the iron. When ethyl alcohol was used as a medium, the plating of the copper seemed to be better than when water was used. When acetone was used as a medium, the metallic pair that resulted was brown in color and had a metallic copper luster. Therefore, acetone was selected as the medium.

Differences in several mediums were caused by their different polarities.

Acetone may be recovered, and the rate of recovery experimental value is around 90 percent.

3. Selection of Iron Powder

For the reduced iron powder, cast iron filings and iron powder from an iron powder plant (the Iron Powder Plant of the Beijing Fireworks Plant) were used as raw materials to prepare the metallic pairs after which the metallic pairs were compared for activity. Experiments were conducted in three-neck flasks fitted with mixers. To the flasks was added water containing 500 milliliters of DDT, after which between 100 and 200 milligrams of metallic pairs was added. Samples were withdrawn for analysis at different times with the results recorded in Table 1.

Table 1. Comparison of Metallic Pairs Prepared From Different Iron Powders

No. of Experiment	Reaction Temperature (°C)	Kind of Iron	Concentration of DDT Residue (milligrams per liter)			
			0 mins.	20 mins.	40 mins.	60 mins.
19	75	Reduced iron	3.90	1.38	1.16	0.42
16	75	Iron powder from iron powder plant	4.82	2.16	2.90	1.68
29	75	Cast iron filings	0.54	0.38	0.29	0.12

Table 1 shows that when metallic pairs made from reduced iron powder were used in reaction with the DDT solution for an hour, the rate of elimination of the DDT from the water was 89 percent. When metallic pairs made from iron powder from the iron powder plant was used in reaction with the DDT solution for an hour, the rate of elimination of the DDT from the water was 65 percent. In the case of metallic pairs prepared from cast iron filings in reaction with a DDT solution for an hour, the rate of elimination of the DDT from the water was 78 percent. In view of the convenience of the source of supply and the cheap price, cast iron filings were selected as the raw material for the preparation of metallic pairs.

11. Results of the Treatment of DDT in Water With Metallic Pairs

We used two experimental methods for results in the metallic pair treatment of DDT in waste water. One was in the three-neck flask in the laboratory, and the other was placing the metallic pairs in a column at the plant. Water for the experiment came from the DDT production workshop of the Tianjin Chemical Plant. In addition to DDT, the water contained chlorobenzene, trichloromethane, and trichloroacetaldehyde. The waste water had a pH of between 3 and 4.

1. Check on Activity Within the Laboratory

The three-neck flask was placed in a 50°C constant temperature bath and 150 milliliters of DDT waste water was added. Then 200 milligrams of metallic pair was added. Every 30 minutes a sample was taken for analysis. Results are shown in Table 2.

Table 2. Comparative Results of Use of Various Metallic Pairs To Eliminate DDT from Waste Water

Metallic Pairs		Fe-Cu Reduced iron powder	Fe-Cu Cast iron filings	Zn-Cu
DDT Con- cen- tra- tion (Milli- grams per liter)	Original water	2.002	18.28	2.333
	30 minute reaction	1.028	11.06	1.019
	Elimination rate (percent)	48	40	56
	60 minute reaction	1.185	10.60	0.857
	Elimination rate (percent)	40	42	63
	90 minute reaction	1.035	8.06	0.683
	Elimination rate (percent)	48	55	70

It may be seen that the activity of the Zn-Cu pair was higher than that of the Fe-Cu pair, and in a comparison of electrode electric potentials, the standard potential for $\text{Zn} \longrightarrow \text{Zn}^{++} + 2\text{e}$ was -0.763 volts; for $\text{Fe} \longrightarrow \text{Fe}^{++} + 2\text{e}$, the standard potential was -0.036 volts; and for $\text{Cu} \longrightarrow \text{Cu}^{++} + 2\text{e}$, the standard potential was +0.34 volts. Therefore the potential loss for the Zn-Cu

pair was 1.103 volts; the potential loss for the Fe-Cu pair was 0.376 volts; and the higher activity of the Zn-Cu pair in comparison with the Fe-Cu pair was apparent.

Table 3 shows results of the experiments on the relationship between pH value and DDT elimination and the solubility vector of the iron. In the experiment, a Cu-Zn pair was mixed with sand (0-40 mesh) at a ratio of 1:4-5 (weight) and placed in a glass tube into which water flowed from the bottom.

It may be seen from Table 3 that pH value which had little effect on the elimination of DDT, though it had a noticeable effect on the solubility vector of the iron. Consequently, before the waste water from the DDT shop of the Tianjin Chemical Plant underwent treatment, it was first necessary to make it neutral, and results of experiments in neutralization are shown in Table 4. Following neutralization, the DDT content of the water was greatly reduced, absorbed by the precipitate of hydroxides rather than hydrolyzed. As a neutralizing solution, either sodium hydroxide or calcium carbide lime water may be used. The volume of the precipitate produced through neutralization is 2 percent, and the dry weight of the precipitate is .0003.

Table 3. Effects of pH Values

pH value	Volume of water flow (milliliters)	Concentration of DDT in water (mgs/liter)	Viscosity of Fe+++ in water (mgs/liter)
3.7	0	0.76	52.4
	550	0.049	682
	800	0.066	730
	1070	0.029	682
	1320	0.035	660
5	0	0.35	56
	530	0.016	83
	980	0.023	150
	1310	0.049	154
6.6	0	0.47	30
	660	0.016	34
	850	0.011	40
	1090	0.009	27
	1300	0.011	22

Table 4. Neutralization Experiment

Sequence of experiments	DDT concentration originally at pH 4	DDT residual concentration in clear solution of pH 7 following neutralization	DDT concentration following dissolving of precipitate through reintroduction of acid to bring pH reading to 1	DDT concentration neutralization, filtering, dissolving of precipitate and dilution to the pH 7 of original water
N1~2	21.55	0.31		
N1~3	21.55	0.49		
N5~6	14.08	0.05		
N5~8	14.08	0.03		
N474851	14.9	0.31	15.28	
N475253	14.9	0.47	15.26	
N384244	1.2	0.15		0.85

Examination was also made of the effect of speed of flow on the elimination of DDT. It was generally hoped that if the speed of flow were somewhat greater, a larger volume could be treated. Our experiments showed that this was so provided the flow of water was kept in contact with the metallic pair bed for about 15 minutes.

2. Check on Activeness at the Plant

After the Fe-Cu pair made from the cast iron filings was mixed with sand, it was placed in a glass or a plastic tube. This was done twice. The first time was for a small experiment when 10 grams of metallic pair was mixed with 40 grams of sand and placed in a glass tube with an internal diameter of 8 millimeters. Results are shown in Table 5. The second time was a medium size experiment in which following the mixing of 1 kilogram of metallic pair with 7.5 kilograms of sand, the mixture was placed in a plastic column with an internal diameter of 78 millimeters. Results of this experiment are shown in Table 6. Before the metallic pair was put in the column, a column of sand was placed inside of it to act as a filter. Speed of water flow in the experiment was 5 meters per hour.

Figured on the basis of results of the experiment shown in Table 6, treatment would cost 0.35 yuan per ton, of which the cost for NaOH neutralizer would be 0.20 yuan per ton and the cost of electricity 0.08 yuan per ton. It can be seen that were waste alkali or calcium carbide lime water to be used as a neutralizer instead, treatment costs would fall greatly.

Table 5. Check on Activity of Catalyst (Small Experiment)

Volume of water flow (liters)		68.5	85	95	116	120
DDT residue concentration (mg/liter)	Before treatment	0.16	0.20	0.14	0.09	0.29
	After treatment	0.08	0.03	0.06	0.04	0.06
Residual Fe^{+++} concentration (mg/liter)	Before treatment	26	44	45	35	64
	After treatment	38	56	54	40	96

Table 6. Check on Activity of Catalyst (Medium Experiment)

Volume of water flow (tons)		1.20	3.6	8.40	12.0	18.0	25.2	32.4	35.4
DDT residue concentration (mg/liter)	Before treatment	1.008	1.324	0.502	0.755	0.966	2.41	0.538	0.636
	After treatment	0.17	0.17	0.030	0.014	0.025	0.023	0.044	0.058

III. Exploration of the Apparent Dynamics of DDT Reduction Using Metallic Pairs

In order to gain a deeper understanding of the reaction involved in the metallic pair catalytic reduction of DDT, some experiments in dynamics were conducted. Into a three-neck flask was placed 200 milliliters of waste water containing DDT, which was held at a constant temperature and into which was mixed 100 milligrams of metallic pair. A sample was removed every half hour for analysis. We used PP'-DDT as the standard and observed changes that took place in the reaction process and then studied the reduction reaction. Results of the experiment are shown in Table 7.

The results of the experiment were used with $\log C$ versus time, t , to make a graph, which is shown in Figure 1.

We believe that (1) on a graph of $\log C$ versus t , a virtually straight line results, demonstrating that the catalytic reduction reaction was a first order reaction and the dynamic formula for a first order reaction is:

$$\frac{-dc}{dt} = kt + a$$

Table 7. PP'-DDT Removal Experiment (PP'-DDT Unit of Concentration: Mg/Liter)

Experiment Number	Kind of Liquid and Type of Metallic Pairs	Reaction Temperature (°C)	P'P-DDT residual concentration and logarithm value			
			Sample withdrawal (minutes)	0	30	60 90
No. 57	DDT dissolved in acetone, and acetic acid used to adjust pH to 3-4. Cu-Zn pair	50	P'P-DDT	43	29.76	22.8
			log	1.63	1.47	1.36
No. 62	Liquid preparation same as above. Cu-Fe pair	50	P'P-DDT	11.2	8.2	6.6 5.2
			log	1.05	0.91	0.82 0.72
No. 67	Water from DDT processing division of Tianjin Chemical Plant with a pH of 3-4. Cu-Fe pair	50	P'P-DDT	2.0	1.5	1.45 1.2
			log	0.30	0.18	0.16 0.08
No. 70	Same as above	75	P'P-DDT	0.70	0.50	0.23 0.15
			log	1.85	1.30	1.36 1.18
No. 77	Same as above	75	P'P-DDT	9.5	6.04	3.40 2.80
			log	0.96	0.78	0.53 0.45
No. 85	Same as above	35	P'P-DDT	26.66	23.66	21.16 18.3
			log	1.43	1.37	1.33 1.26

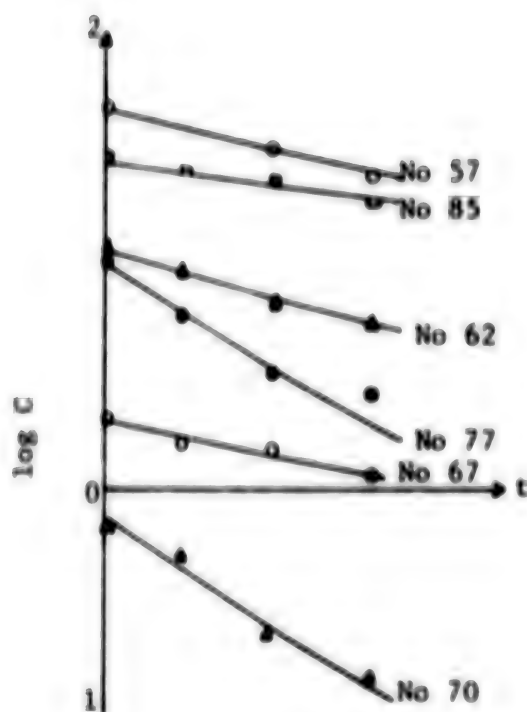


Figure 1. Log C-t Graph

The integral formula is $-\ln C = kt + a$, with the C in the formula being the concentration at the time, t, of reaction, k being a reaction speed constant, and a being an integral constant. Since it is a first order reaction, it can be said that the elimination reaction of PP'-DDT under conditions of the experiment was only a linear equation direct ratio of the PP'-DDT concentration.

(2) From the three experiments, No 67, No 70, and No 85 may be seen the effect of temperature on the reactions. No 70's rectilinear slope is great; No 67's is second; and No 85's is smallest. This demonstrates that the higher the temperature, the faster the elimination of PP'-DDT. From Figure 1 the reaction speed constants may be separately calculated as follows: $k_{75^{\circ}\text{C}} = 1.25 \times 10^{-4}$ / second; $k_{50^{\circ}\text{C}} = 0.42 \times 10^{-4}$ / second; $k_{35^{\circ}\text{C}} = 0.3 \times 10^{-4}$ / second. From a look at the numerical value of k, the reaction of the metallic pair in reducing DDT does not proceed very rapidly. (3) On the basis of rough calculations for $k_{75^{\circ}\text{C}}$ and $k_{50^{\circ}\text{C}}$, the activation energy of the reaction is:

$$\ln \frac{k_{T_1}}{k_{T_2}} = \frac{E}{R} \left(\frac{T_1 - T_2}{T_1 T_2} \right)$$

In the formula, k_{T_1} and k_{T_2} are reaction rate coefficients for T_1 and T_2 respectively.

E--activation energy

R--gas constant of 1.987 calories/gram molecules $\cdot ^{\circ}\text{C}$

Substituting the above calculated value of $k_{75^{\circ}\text{C}}$ and $k_{50^{\circ}\text{C}}$ yields $E = 10.169$ kilocalories per gram molecule. The activation energy of this reaction is not so high, demonstrating that this reaction is in the catalytic category.

Experimental results for the related several reaction mechanism conditions are shown in Table 8.

Table 8. Experiments Exploring Mechanism Conditions

No of Experiment	Conditions of Experiment	Reaction Temperature ($^{\circ}\text{C}$)	DDT concentration at t (milligrams/liter)			
			0 min	30 min	60 min	90 min
No 79	Comparison of with and without catalyst	75	0.8	0.5		0.3
			0.8		0.8	
No 88	Water-free solvent plus catalyst	50	11.4	12.0	12.0	11.8 12.4
No 80	Electrolytic reduction (copper at negative pole & iron at positive with 6 volts applied voltage)	18	1.34	0.415	0.48	
No 98	Battery reduction (copper and iron poles connected to form a circuit with no applied electrical source)	14	0	2 hrs	5 hrs	24 hrs 28 hrs
			16.17	15.85	11.10	2.6 1.65

Table 8 shows that: (1) the metallic pair catalyst is functional. (2) It is hydrogen that performs the reducing function; therefore when acetone was used as a solvent after drying, no reducing reaction occurred. (3) Within the metallic pair catalytic reduction reaction was an electrode reduction reaction.

The reaction to metallic pair reduction of the DDT in the wastewater may possibly have been both a catalytic reduction reaction and an electrode reduction reaction. Both zinc and iron possess a reductivity and the surface copper acted as a catalyst. Furthermore, metallic pairs in water form a rudimentary battery, and the electrons given off from the metal at the high electric potential electrode is released at the surface of the metal at the low electric potential electrode, after which it functions together with the H^+ in the water to reduce the DDT.⁴

V. Conclusions [numbering as published]

On the basis of the experiment, we believe:

1. The use of a neutralizing precipitate-filter-metallic pair reduction technical process can eliminate DDT from waste water. In the case of the DDT production shop at the Tianjin Chemical Plant, it was able to reduce the concentration of DDT in the effluent to below the standards for surface water. The absolute quantity of DDT flushed away declined from the annual more than 200 kilograms to below 2 kilograms.
2. The metallic pair catalytic reduction method is an effective method for eliminating small quantities of DDT from water.
3. The metallic pair reduction reaction on DDT in water is a prime reaction, which first reduced DDT to DDD after which it further degrades it. The less the chlorine content of the molecules, the less the toxicity.
4. Evaluation of the products of reduction and machine reduction await further study.

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PARATHION RESIDUE, ITS METABOLITE PARAOXON ANALYZED

Beijing HUANJING KEXUE [ENVIRONMENTAL SCIENCE] in Chinese Vol 1 No 6, 30 Dec 80 pp 5-9

[Article by Zhou Zhenhui [0719 2182 1920] and Pan Guangming [3382 0342 2494], Shanghai Insect Institute, Chinese Academy of Sciences: "Determination of Parathion Residue and Its Metabolite Paraoxon"]

[Text] Analysis of residual quantities of organic phosphorous and carbamate type of pesticides and of metabolites or enzyme inhibitors using the thin-layer chromatography-enzyme inhibition method (abbreviated as TLC-EI) detected nanogram (10^{-9}) or even pico (10^{-12}) quantities.

The principles and applications of this method have been exhaustively reported,¹⁻⁸ but as yet no reports have appeared inside China or abroad of the use of the quantitative method using zigzag scanners directly on enzyme inhibiting pesticide spots on thin layer plates.

We used dual wave-length chromatographic scanners to scan the quantity of residual 1605 [parathion] pesticides and their enzyme inhibitor metabolite, paraoxon in unpolished rice and rice chaff. Detection limit was 10^{-10} grams; degree of accuracy of quantities was <5 percent; degree of precision of quantity by repeated scanning of spots was <0.3 percent. Exploration was also made of the dual wave-length selection of the enzyme inhibitor spots and the linear parameter set-up according to the Kubelke-Munk formula.

Experimental Method

I. Reagents and Equipment

1. Thin layer chromatographic plate. To 50 grams of silica gel G (E. Merck) add 100 milliliters of distilled water and using a Stahl applicator spread it on a 20 x 20 centimeter thin layer plate to a thickness of 0.5 millimeters. After drying it for 5 minutes at room temperature, heat at 110°C to activate for 1 hour and store in a desiccator for use.
2. Spreader: n-hexane; acetic ethyl ester (3:1).

3. Preparation of enzyme solution: Homogenize the liver of a small white mouse in distilled water in an homogenizer, and then place in a centrifuge for 15 minutes at a speed of 4500 revolutions per second. Pour off the clear liquid into a container and store in refrigerator for use. The ratio of mouse liver to distilled water is 1:30 (W/V).

4. Substrate

(1) Weigh out 5.4 milligrams of β -naphthylacetic ester and dissolve in 4 milliliters of anhydrous ethanol.

(2) Dissolve 20 milligrams of colorfast blue B in 16 milliliters of distilled water.

Just before using, mix (1) with (2).

5. Standard solution of pesticide: Use acetone to make a solution of 1605 (prepared by the Shanghai Institute of Entomology at a purity of 98 percent) and paraoxon (made by the West German Pestanal Company, purity 99 percent) of 1.6, 3.2, 4.8, and 6.4 milligrams/100 milliliters. Next, take 1 milliliter of each of the above solutions and dilute them to a fixed volume in a 10 milliliter container. Thus, each of the standard solutions will contain 1.6, 3.2, 4.8, and 6.4 millimicrograms/microliters of 1605 and paraoxon pesticides.

6. Instrument: Shimazu dual wavelength thin layer chromatographic scanner, Type CS-900 with Chromatopac EIA microprocessor.

II. Steps in Analysis

1. Extraction

Grind the unpolished rice sample into rice flour and put through a 40 mesh sieve. Then place 25 grams in a Soxhlet extractor and use 80 milliliters of acetone in continuous flow to extract for 6 hours; then measure into a 25 milliliter volumetric flask.

If a rice chaff specimen is used, place 5 grams in the Soxhlet extractor, and use 80 milliliters of acetone in continuous flow to extract for 6 hours, measuring into a 25 milliliter volumetric flask.

2. Thin layer chromatographic separation--enzyme inhibitor

Using a 10 microliter microinjector, dot the thin layer plate with 10-20 microliters of unpolished rice extract. Each thin layer plate may be dotted with 4-6 specimens and a series of 3-5 standard solutions of pesticides of different concentrations. After dotting has been completed, spread 10 centimeters in the spreader (this will require about 25 minutes). Take out the thin spreading plate, and wait until the solvent has completely evaporated; then spray with 15 milliliters of a 3 percent aqueous bromine solution and heat in a 50°C oven for 10 minutes to get rid of the excess bromine. Next spray with 30 milliliters

of enzyme solution and after the thin layer plate has been kept at 30°C for 30 minutes, lightly spray it with 20 milliliters of the mixed substrate solution i.e., until the violet background color shows colorless spots of the pesticide enzyme inhibitor (after having been developed it is completely stable, and it may be kept for more than half a month). The R_f value of 1605 is 0.70; the R_f value of paraoxon is 0.25.

3. Quantitative Scanning

Place the thin layer plate in the scanner and do an absorption spectrum scan using the dual wavelength zigzag line reflection method. Scanning conditions are as follows:

Specimen wavelength (λ_s): 420 nm
Reference wavelength (λ_R): 530 nm
Linear parameter (S_x): 10
Slit: 1.25 X 1.25 mm
Scanning speed: 10 mm per minute
Recorder sensitivity: X1
Speed of recording paper: 10 mm per minute

Both the analytic parameters and the calculated parameters of the EIA microprocessor were run by the group set method. The quantitative calculation method used the extrapolated method. While recording scanning peaks for recorded spots on the recording paper at the time of scanning, the microprocessor directly printed out the content of the specimen, expressing it in nanogram units.

Conclusion and Discussion

1. Selection of Wavelength

The scanning wavelengths for enzyme inhibitor spots in pesticides have not been encountered in literature as of this time. Since the background color of the thin layer plate is violet while the pesticides are colorless, the absorption peaks obtained by using the normal position is a negative peak and the absorption spectrum is as shown in Figure 1. A negative peak signal cannot be inputted to a linear device. In order to be able to input the absorption peak signal into the linear device to carry out correction of the Kubelka-Munk formula, we used a method opposite to the ordinary one for selecting an ordinary wavelength, namely for the specimen wavelength (λ_s) selection of the smallest absorption wavelength, and for the reference wavelength (λ_R) selection of the largest absorption wavelength. In order to bring the light paths into balance, this experiment used λ_s as 420 nm; and λ_R as 530 nm, and more than 50 experiments confirmed the selection of the two wavelengths mentioned above to be correct.

2. Increasing the Recovery Rate

After removing the hulls from 5 kilograms of paddy rice to get unpolished rice, and then grinding this into rice flour in a grinding machine, it was put through a 40 mesh sieve and sifted. It was then divided into 25 gram portions of unpolished rice flour (to make a total of 16 portions, divided into 4 groups). Each was placed in a 250 milliliter beaker, with one of the 4 groups being used

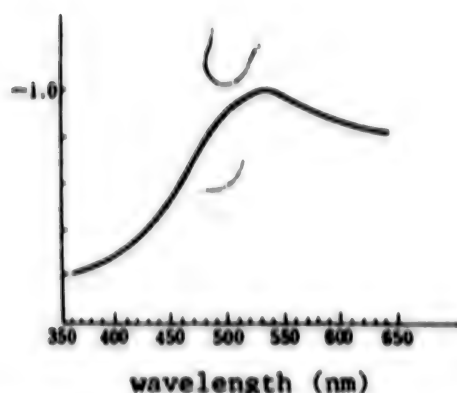


Figure 1. Thin Layer Chromatogram--Normal Position Scanning Absorption Spectrum Graph for Pesticide Enzyme Inhibitor Spots in Enzyme Inhibiting Methods. Absorbant: silica gel G (E. Merck)

as a blank control. Each of the remaining 3 were placed in 15 milliliters of 1605 pesticide and standard paraoxon solution (the standard solution for the first group had a strength of 2.50 milligrams/15 milliliters of 1605 and paraoxon for each portion), each portion in the second group had a content of 12.5 milligrams/15 milliliters of 1605 and paraoxon. In the third group, each portion contained 25.0 milligrams/15 milliliters of 1605 and paraoxon. The immersed unpolished rice specimens were kept at room temperature for 15 hours, and after the pesticide had slowly penetrated the specimens and had volatilized, it was placed in the Soxhlet extractor and 80 milliliters of acetone was circulated through the extractor for 6 hours and volumetrically quantified in a 25 milliliter volumetric flask.

The increased rate of recovery in this experiment went from 0.1 - 1.0 ppm. The recovery rate for the paraoxon was 70.2 - 109.1 percent for an average recovery rate of 89.05 percent. In addition in the control using gaseous phase chromatography, the recovery rate was 82.3 - 100.7 percent for an average recovery rate of 90.5 percent. Because of the excessive disturbance to the specimen group at 0.1 ppm in the gaseous phase chromatography, a control was run only on 0.5 and 1.0 ppm. For results of the increased recovery rate for paraoxon see Table 1.

The increased recovery rate for 1605 was 91.79 - 105.40 percent, for an average recovery rate of 98.03 percent. The gaseous phase chromatography method showed a recovery rate of 96.3 - 128.3 percent for an average recovery rate of 110.50 percent. Increased recovery rates for 1605 are shown in Table 2.

From Tables 1 and 2 it may be seen that the results from the thin layer chromatography--enzyme inhibitor scanning method to determine quantity--are identical with the experimental results of the gaseous phase chromatography method.

Specimen No.	Added concentration	Volume spotted on specimen (μl)	Equivalent to additional pesticide volume (ng)	Amount re-covered (ng)	Recovery rate (percent)	Gaseous phase chromatography recovery rate (percent)
1.1	1	10	10	10.912	109.1	86.3
1.2		10	10	9.730	97.3	84.0
1.3		10	10	10.301	103.0	84.0
1.4		10	10	9.825	98.25	84.0
2.1	0.5	20	10	9.555	95.6	100.7
2.2		20	10	7.017	70.2	82.3
2.3		20	10	7.791	77.9	96.5
2.4		20	10	7.174	77.7	93.4
3.1	0.1	20	2	1.982	99.1	
3.2		20	2	1.514	75.7	
3.3		20	2	1.605	80.25	
3.4		20	2	1.689	84.45	
4.1	CK	20	0	0		
4.2		20	0	0		
4.3		20	0	0		
4.4		20	0	0		
average recovery rate					89.05	90.50

Specimen No.	Increased concentration (PPm)	Volume spotted on specimen (μl)	Equivalent to added pesticide volume (ng)	Volume re-covered (ng)	Recovery rate (percent)	Gaseous phase chromatographic method recovery rate (percent)
1.1	1	10	10	9.179	91.79	96.3
1.2		10	10	9.263	92.63	100.0
1.3		10	10	9.347	93.47	102.7
1.4		10	10	9.600	96.0	106.0
2.1	0.5	10	5	4.924	98.48	116.7
2.2		10	5	5.252	105.4	128.3
2.3		10	5	5.252	105.4	118.4
2.4		10	5	5.09	101.80	115.6
4.1	CK	10	0			
4.2		10	0			
4.3		10	0			
4.4		10	0			
average recovery rate					98.03	110.50

Linear Parameters

Inasmuch as the medium is a nontransparent adsorbent, at the time of scanning to determine amounts by the thin layer chromatographic reflecting method, it was not consistent with Beer's law. Therefore, the concentration of the material and the degree of absorption of light do not present a simple linear relationship, and only after using the Kubelka-Munk formula to find the linear parameters of the thin layer can good linearity be presented between the concentration of the material and its integral value. The writers used 3.2 - 12.8 millimicrograms of a series of different concentrations of standard samples of paraoxon to make an S_x 3 - 10 linear relationship graph (see Figure 2).

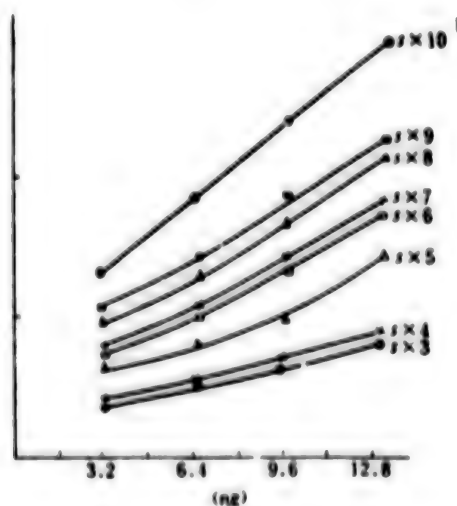


Figure 2. Linear Parameter Graph of Paraoxon Pesticide Enzyme Inhibitor Spots

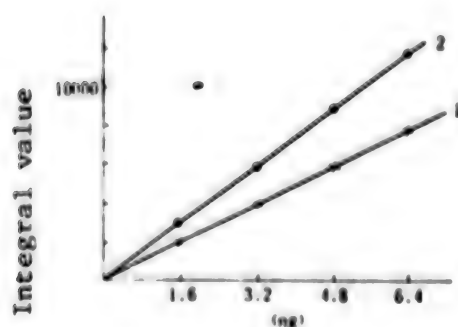


Figure 3. Working Curve for Pesticide Enzyme Inhibitor Spots. 1.1605.
2.Paraoxon

From Figure 2 it may clearly be seen that when the thin layer plate was used in the linear parameter $S_x = 10$, not only were the linear relationships good, but the degree of sensitivity derived was also very high. Therefore the linear parameter (S_x) used in this method was 10.

The experiment demonstrated that when the 1605 and the paraoxon pesticide enzyme inhibitor spot was below 6.4 millimicrograms, the working curve was a straight line that went through the original point, (Figure 3); however, when the material was fairly thick or when the developed thin layer plate was put aside for half a month or more before being measured, the working curve did not go through the original point even though it still presented a good linearity. This phenomena accords with the results reported by Yamamoto Yushi [1472 2609 5940 1807].

Because of the difficulty in spraying a uniform amount of enzyme liquid and substrate solution on each piece of thin layer plate, we additionally spotted 3 or 4 standard samples of different concentration on each piece of thin layer plate, so in making the working curve for each thin layer plate, the degree of standardization of fixed amount is <5 percent.

The degree of sensitivity derived by this method is as high as 10^{-10} grams (<0.5 nanograms); therefore the volume spotted on the specimen was very little, generally only 10 - 20 milligrams being required. Thus, the extract from the specimens could not be purified, and 0.05 ppm of paraoxon and 0.1 ppm of 1605 pesticide remnants were directly measured on the thin layer plate (in Japan, the permissible quantity of residue in various crops is 0.1 ppm).

Verification of the Analysis and Methods of the Environmental Samples

All the environmental specimens consisted of 12 items selected from the medium maturing rice crop harvested in October 1979 in Chongming and Jiading counties in Shanghai, and unpolished rice and rice chaff from each of these 12 items were directly measured for 1605 and for paraoxon without any purification of them. Results of measurements of the chaff specimens are detailed in Table 3.

Table 3. Results of Measuring Rice Chaff Specimens From Chongming and Jiading Counties in Shanghai, 1979

Specimen Number	Amount spotted on specimen (microliters)	Equivalent to specimen amount for rice chaff (milligrams)	Measured amount (millimicrograms)	
			1605	Paraoxon
1	30	6	--	--
2	30	6	--	--
3	30	6	--	--
4	30	6	--	--
5	30	6	--	--
6	30	6	0.184	2.097
7	30	6	0.576	2.160
8	30	6	0.466	1.933
9	30	6	0.605	0.718
10	30	6	0.711	1.426
11	30	6	0.559	1.557
12	30	6	--	--

In order to verify methods, the paraoxon in specimens numbers 6-11 was measured with the CS-910 scanners in the Shanghai Institute of Pesticides and in the Qingdao Academy of Medicine [sic]. Results are shown in Table 4.

Table 4. Result of Measurement in Rice Chaff Specimens in CS-900 and CS-910 Scanners

Specimen Number	Results of test in CS-900 at Shanghai Insect Institute [sic] (millimicrograms)	Results of tests in CS-910 at Shanghai Academy of Medicine (millimicrograms)	Absolute error
6	2.097	2.057	0.040
7	2.160	2.590	0.430
8	1.933	1.830	0.103
9	0.718	1.049	0.331
10	1.426	1.333	0.093
11	1.557	1.226	0.331

Table 4 shows that as a result of the use of two different types of thin layer chromatograph scanners at two different units, test results for paraoxon on individual specimens were the same.

This method of verification had the participation of Comrade Ma Yicai [7456 0110 2088] of the Shanghai Institute of Pesticides and of Comrade Ding Yufang [0002 3768 5364] of the Qingdao Medical College. The gaseous phase chromatograph data was verified by Comrade Chen Xiangda [7115 0686 6671], and Comrade Wang Huiju [3769 6540 5468] participated in some of the work. Thanks are tendered to all.

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EFFECTS OF MERCURY ON RICE, RAPE INVESTIGATED

Beijing HUANJING KEXUE [ENVIRONMENTAL SCIENCE] in Chinese Vol 1 No 6, 30 Dec 80
pp 50-52, 13

[Article by Qu Aiquan [4234 1947 2938], Chinese Academy of Environmental Sciences, and Dong Huiru [2639 1920 1172] and Li Junguo [2621 0193 0948], Vegetable Research Laboratory, Chinese Academy of Agricultural Sciences: "A Preliminary Investigation of Mercury Effects on Rice and Rape"]

[Text] Mercury is the principal harmful substance in the industrial effluent of chemical, pharmaceutical, electroplating, and instrument plants, and it is a cumulative metallic poison. Mercury in waste water accumulates in the soil and in crops (including animal fodder) as a result of irrigation, finally going through the food chain to enter the human body where it causes great damage. By way of formulating farmland irrigation water quality criteria, and in order to provide definite scientific data on large area irrigation pollution, in both 1974 and 1975 we conducted experimental plantings in pots of paddy rice and rape.*

Materials and Methods

1. Experimental Methods

We used soil culturing in pots, the test crops provided being paddy rice (Jingyue No 1) and rape (Wuyuean). The soil in the pots was sandy; the pots were filled according to weight, and watering was done according to volume.

2. Handling of the Experiment

(1) Effect of mercury on paddy rice and rape (calculated at a Hg^{+2} concentration in the $HgCl_2$) in the water used for watering.

a. Treatment concentrations in 1974: 0, 0.025, 0.25, 2.5, 25, and 50 milligrams per liter.

b. Treatment concentrations in 1975: 0, 0.005, 0.01, 0.1, 0.5, and 2.5 milligrams per liter.

*Experiments were conducted at the Beijing Municipal Institute of Agriculture

Throughout the period of growth, watering was done with water containing mercury at each of the above treatment concentrations.

(2) Effects of mercury in the soil on paddy rice and rape.

During 1975, paddy rice and rape were grown separately in the soil in the experimental pots that had been watered in 1974 with mercury solutions of different concentrations, and watering was done with clear water throughout the growing season. Each treatment was repeated four times. Monitoring of the residual quantity of mercury in agricultural products and in the soil was done by the vanadium pentaoxide method and the 590 type mercury testing device.

Results and Analysis.

Effects on growth and output of paddy rice and rape of mercury in watering water and its persistence and accumulation in plants and in the soil.

(1) Effects of different concentrations of mercury on the growth and output of rice and rape.

It may be seen from Table 1 on the experiments with rice and Table 2 on the experiments with rape that there were no adverse effects either on growth or output from a mercury solution of below 0.25 milligrams per liter used for watering. When a 2.4 milligrams per liter mercury solution was used to water the rice, it had an inhibiting effect on the growth of the rice, obstructing growth. Output declined. At this concentration, the live weight of individual rape plants fell by 12.3 percent over the control plants.

Rice output is determined by a combination of factors including the effective number of panicles, the number of grains per panicle, and the weight per thousand grains. It is apparent from Table 1 that the principal reason output for paddy rice impairment by the 2.5 milligrams per liter mercury solution as compared with the control was a 27.8 percent decline in the number of grains per panicle, a 1.05 gram reduction in the weight per thousand grains, and an increase in the number of empty husks. This demonstrates that mercury's impairment of growth was rather more serious during the differentiation of the heads, and impairment also occurred when the rice was in the milk stage. As concentrations were increased in the treatments, impairment to all of the elements that go into rice output increased. Rice treated with 25 milligrams of mercury per liter of water showed a 20.6 percent decline in the number of effective panicles on each plant; the number of grains per panicle fell by 46.7 percent, and there were 2.2 times more empty husks than in the controls. Treated with 50 milligrams per liter, no heads formed on tillers but only on the main stem. Number of grains per panicle fell by 70.8 percent as compared with the control, and the number of empty husks dramatically increased 5.4 times over the controls. Each plant had only 0.2 grams of output.

Table 1. Impairment Caused to the Factors in Paddy Rice Output by Different Concentrations of Mercury

Treatment concentration (mg/liter)	Items checked Plant height (cm)	Effective No. of panicles (panicles per plant)	No. of grains per panicle (grains)	Empty husks (grains per panicle)	Per 1000 weight of grain	Output (grams per plant)	Reduction in output (percent)
0	103.2	6.8	103.8	2.1	25.20	14.5	--
0.025	107.1	6.8	98.2	4.1	24.95	15.6	--
0.25	109.2	7.2	99.3	4.0	24.30	16.1	--
2.5	90.5	6.5	74.9	4.1	24.15	11.4	21.4
25	70.0	5.4	55.3	4.7	24.40	7.1	51.0
50	52.3	1.0	30.3	11.4	21.80	0.2	98.6

Table 2. Effects on the Growth of Rape of Different Mercury Concentrations

Concentration of treatment	Items checked	Date 23 May 1975		
		Maximum leaf length (cm)	Maximum leaf width (cm)	Live weight (grams/plant)
0		19.7	8.3	30.9
0.005		20.2	7.9	31.1
0.01		20.2	8.0	30.0
0.1		20.3	7.8	29.5
0.5		20.4	8.6	29.6
2.5		19.4	8.2	27.1

(2) Residual quantities of different concentrations of mercury in unpolished rice and in rape.

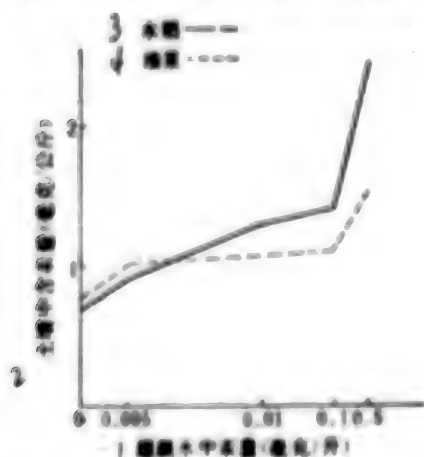
The residual rate for mercury in unpolished rice and in rape was calculated from the residual quantity of mercury in unpolished rice and in rape from the infusion of a quantity of mercury by watering throughout the growth period in experiments with potted plants. The residual amount of mercury in the crops

increased according to the increase in mercury concentrations in the water used for watering. The residual rate in rape of different concentrations of mercury was roughly the same. This demonstrates that the rape absorbed mercury in virtually the same proportions, while the residual rate in the unpolished rice formed a negative relationship with the concentration in the water used for watering, i.e. the greater the concentration of mercury in the water, the lower the proportion entering the unpolished rice. In addition, the residual quantity of mercury bore a relationship to the kind of crop and to the amount of watering. If the treatment concentration was 0.1 milligrams per liter, the residual quantity of mercury in the unpolished rice was 0.28 milligrams per kilogram, and 0.14 milligrams per kilogram in the rape. This was because of the biological characteristics and the large quantity of water needed by the paddy rice. Throughout the growing period, a fixed water level was maintained for the paddy rice, which helped the roots of the rice absorb mercury from the solution in the soil.

When the rice was watered with 0.01 milligrams of mercury per liter, the mercury content of the unpolished rice exceeded China's national standards of "Permitted Amounts of Mercury in Foodstuffs" of 0.02 milligrams per kilogram. After the rice was harvested, the roots, stems, leaves, husks and unpolished rice were checked for mercury content in plants that had been watered with water containing different concentrations of mercury. Per unit quantity of mercury in descending order was roots-stems-leaves-husks-unpolished rice. Quantity of mercury in the roots was 59.22 percent that in the entire plant. Quantity in the leaves was 31.28 percent, in the husks 5.02 percent, and in the unpolished rice 4.46 percent.

(3) Accumulation of mercury in the soil from watering of rice and rape.

After the rice and the rape were harvested, analysis was made of 0-20 grams of the potting soil. Concentrations of mercury in the soil increased as concentration of mercury in the watering water increased (see Figure 1). Even in the case of the water that contained only 0.005 milligrams of mercury per liter, after long watering the top layer of the soil still showed accumulation of mercury. Given the same treatment, the residual mercury in the soil in which the rice was grown was greater than in the soil in which the rape was grown, mainly for the reason that the volume of watering of the rice was greater.



Key:

1. Quantity of mercury in the water used for watering (milligrams per liter)
2. Quantity of mercury in soil (milligrams per kilogram)
3. Paddy rice
4. Rape

Figure 1. Accumulation of Mercury Water Used for Watering in the Pot Soil

When the soil was divided into layers from 0-5 centimeters deep and from 5-20 centimeters deep and tests made for quantity of mercury, results showed that the mercury was concentrated mainly in the top 0-5 centimeter surface of the soil. In the case of treatment of paddy rice with a concentration of 2.5 milligrams of mercury per liter, the 0-5 centimeter deep top layer of soil in the pots showed 7.9 times as much mercury as the control, while below a depth of 5 centimeters, the increase was only 1.9 times. This shows that the mercury that enters the soil is adsorbed by the soil, but that it does not easily migrate.

2. Effects of mercury in the soil on growth and output of paddy rice, and its persistence in plants.

(1) Effects of different concentrations of mercury in the soil on the growth and output of paddy rice and rape.

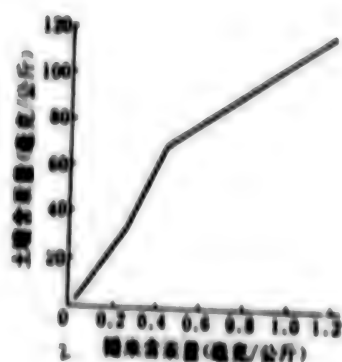
Table 3 shows that when the quantity of mercury in the soil is less than 4.69 milligrams per kilogram, there is no noticeable effect on rice output. As the quantity of mercury in the soil continues to increase, the effect on growth and output of rice gradually increases. This differs from the results obtained in 1974 when a 2.5 milligram per liter solution of mercury in water was used to water rape and resulted in a decrease in rape output, demonstrating that the damage caused in rape is greater from mercury in the water used for watering than from mercury in the soil. Possibly this has something to do with the smaller quantity of water used for the dryland crop rape than for paddy rice, with the result that the amount of mercury adsorbed into the soil in 1974 went less into solution in 1975, thereby reducing the damage to the growth of the rape. This shows that soil has a certain ability to purify itself of toxic substances, thereby reducing the toxicity of crops.

(2) Persistence in unpolished rice and rape from different concentrations of mercury in the soil.

Although the damage done to growth of rape from different concentrations of mercury in the soil was less than the damage done from mercury in the water used for watering, there are limits to the ability of the soil to cleanse itself of toxic substances, therefore not all of the mercury in the soil was adsorbed by the soil; a portion of the mercury persisted in the rape. There was a direct relationship between the residual amount in the rape and the accumulation of mercury in the soil, and the quantity of mercury in the unpolished rice there was also a direct relationship with the quantity of mercury in the soil (see Figure 2).

Table 3. Effects of Mercury in the Soil on the Growth of Paddy Rice and Rape

Mercury concentration in 1974 waterings (mg/liter)	Paddy rice			Rape			
	Quantity of mercury in soil in 1975 before plant-ing (mg/liter)	Plant height (cms)	Output (grams per plant)	Quantity of mercury in soil in 1975 before sow-ing (mg/liter)	Maximum leaf length (cms)	Maximum leaf width (cms)	Live weight (grams/plant)
0	1.41	113.8	16.3	1.16	20.7	8.0	30.5
0.025	1.80	109.6	14.6	1.28	20.8	7.8	35.7
0.25	4.69	109.1	16.0	1.54	20.3	7.5	33.7
2.5	33.44	112.2	13.7	5.96	21.3	8.0	33.5
25	69.89	101.4	11.1	9.38	21.0	7.7	35.0
50	118.83	91.6	6.0	17.73	20.4	7.8	30.8



Key:

1. Mercury content of soil (mgs/kilos)
2. Mercury content of unpolished rice (mgs/kilos)

Figure 2. Relationship Between Mercury in Soil and Mercury Content of Unpolished Rice

Brief Summary

1. Mercury content of below 0.25 milligrams per liter show no apparent effect on the growth or output of paddy rice, and a mercury content of 0.5 milligrams per liter shows no noticeable effect on the growth of rape. Mercury content of 2.5 milligrams per liter begins to show an inhibiting affect on the growth of both paddy rice and rape.

2. Residual quantities of mercury in unpolished rice and rape increase as the concentration of mercury in the water used for watering increases. Distribution of mercury in the various organs of paddy rice in descending order is roots-stalks and leaves-husks-unpolished rice.

3. The mercury content of the soil increases as the concentration of mercury in the water used for watering increases. The mercury that enters the soil from the water used for watering concentrates principally in the top 0-5 centimeters of the soil. Water used for watering with a mercury content of 0.005 milligrams per liter, even though it accumulates only in the top layer of the soil, will eventually pollute the soil creating damage to the crops.

4. Agricultural crops are able to absorb mercury from polluted soil, and the mercury content of crops is directly related to the accumulation of mercury in the soil.

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EFFECTS OF AIRBORNE PARTICULATES ON SOLAR RADIATION IN SHENYANG AREA

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pp 9-13

[Article by Han Xishan [7281 3886 1472] and Wang Jingqian [3769 2529 0051],
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"Effects of Airborne Particulates on Solar Radiation in the Shenyang Area"]*

[Text] All sorts of granules and airborne particulates enter the atmosphere through natural means (volcanic eruptions and forest fires) and the activities of man (fly ash and exhausting of waste gases), thereby fundamentally changing the quality of the atmosphere and creating atmospheric pollution. This leads to a noticeable change in the amount of solar radiation on the earth's surface, a fact that is widely acknowledged.

To make an overall assessment of the gradual changes over the years in the air quality of an industrial city through environmental science is very difficult for the reason that there is a great dearth of continuous monitoring data for air pollution over a long period of time. The objective of this article is to try to use the methods of atmospheric physics to undertake a quantitative appraisal from the overall optical properties of the atmosphere. We will start with an analysis of many years data about solar radiation in Shenyang derived from actual measurements made on the ground there, will make calculations, and use indirect methods to extrapolate the changes in atmospheric pollution over a fairly long period of time.

1. Data

We made a survey of solar radiation data for noon and sunny days for the winter season (December to February) from the Shenyang Nanhu Meteorology Station for the period 1959-1978. We selected 3,000 pieces of data to form the basic materials for our analytical work. We selected what were considered to be the major annual changes in pollution in Shenyang for the months of December to February and determined the unfavorable meteorological conditions there during

*Comrades Zhou Lin [0719 3829] and Zhang Xifu [1728 6932 4395] reviewed this article and made numerous helpful suggestions for revisions, for which appreciation is hereby expressed.

the winter season. The effects of clouds on solar radiation are extremely important. We selected sunny and cloudless weather (i.e. when sunshine monitoring records were \odot^2 for quantity of radiation) for analysis, thus virtually eliminating the effects of cloud cover in diffusing direct solar radiation and thereby simplifying the problem of analytical discussion.

2. Overall Weakening of Solar Radiation

Solar radiation from outside the atmosphere is weakened by the atmosphere's scattering and absorption of rays. The weakening caused by scattering includes scattering caused both by molecules in the atmosphere and the water droplets, dust, impurities, and such mingled microscopic pollutants. In sunny, cloudless weather, the atmospheric content of water in the liquid state is next to nothing, so it virtually need not be considered as scattering radiation. Thus, the weakening of solar radiation in the atmosphere is caused principally by water vapor, ozone, carbon dioxide, dust impurities and such combinations of pollutants. Of these, the absorption of solar radiation by water vapor plays a major role, while the role of absorption and weakening played by ozone, carbon dioxide and dust cannot be overlooked either. In cities with heavy industry where a large volume of pollutants are discharged, they appear more important.

The overall weakening of the sun's radiation caused by the scattering effect of atmospheric molecules, the scattering and absorption of radiation by water vapor, and the scattering and absorption occasioned by dust impurities is termed the total atmospheric extinction effect, which is expressed by the formula

$$Q_{\lambda} = Q_{\lambda g} + Q_{\lambda w} + SQ_{\lambda s} \quad (1)$$

In this formula Q_{λ} represents the atmosphere's total extinction coefficient.

$Q_{\lambda g}$ represents the scattering coefficient of atmospheric molecules

$\omega Q_{\lambda w}$ represents the absorption coefficient of water vapor

$SQ_{\lambda s}$ represents the scattering and absorption coefficient of dust, airborne particulates and such adulterants.

ω and S represent the water vapor and dust content of the atmosphere.

It is not difficult to see from the formula that the greater the water vapor and dust content of the atmosphere, the greater the total extinction effect, and the less the quantity of radiation from the sun directly received on the surface of the earth.

The objective of this article is to make use of this formula to figure out the extent to which the individual components of molecular scattering, absorption by water vapor, and dust pollutants weaken solar radiation. Thus, on the basis

of the changes over the years in the weakening of radiation from a mixture of pollutants, we will deduce the changes over the years in the dust pollutant content of the atmosphere, and proceed to evaluate the quality of the air in Shenyang.

(1) Weakening by molecular scattering

In an ideally pure atmosphere, the direct rays of the sun would be effected only by molecular scattering. The strength of the direct rays after scattering by atmospheric molecules may be expressed in the following formula:

$$S_m = S_o [1 - (1 + 0.265m)^{-0.325} - 0.112] \quad (2)$$

In this formula, S_m is the quantity of direct rays that have gone through the clean atmosphere.

S_o represents the quantity of direct rays reaching the upper atmosphere

m represents the quality of the atmosphere.

The extent of weakening by molecular scattering may be represented by the following formula:

$$S_{\text{molecules}} = S_o - S_m \quad (3)$$

In this formula, $S_{\text{molecules}}$ is the extent of molecular scattering.

These two formulas reflect only the change in that portion of the direct rays weakened by molecular scattering in an otherwise pure atmosphere. As atmospheric quality, m , increases, the optical distance traversed by the light rays increases, and the greater the number of atmospheric molecules involved in scattering, the greater the weakening of direct radiation.

The 21 year average value of weakening of the sun's rays through scattering by atmospheric molecules on sunny winter days in Shenyang, as derived from statistical tabulations, was 0.292 or 15.0 percent of the total. Variation from year to year was slight, not exceeding ± 1 percent. This demonstrates that the main reason for the year to year changes in direct solar radiation measured on the earth's surface has not been weakening by molecular scattering.

(2) Weakening through absorption by water vapor

A "clean" atmosphere is only an atmosphere in an ideal state. Real atmospheres always contain a certain quantity of water vapor. Inasmuch as this water vapor selectively absorbs solar radiation, it affects the amount of direct radiation reaching the earth's surface. Absorption of solar radiation by water vapor is extremely complex. Under most circumstances, some fairly simple test calculation formulas are used to make rough calculations. The Miaogai [5379 5556] [phonetic] and Mule [1191 0519] water vapor absorption formula is as follows:

$$S_{\text{water}} = 0.172 (m \cdot \omega_{\infty})^{0.303} \quad (4)$$

This is used to calculate quantity.

In the formula, S_{water} represents the amount of solar radiation weakened by water vapor absorption.

m represents the quality of the atmosphere at the time

ω represents the water vapor content in a vertical column through all layers of the atmosphere. The water vapor content, ω_{∞} is derived by the formula

$\omega_{\infty} = 2.1 e_0$ with e_0 representing absolute humidity at the earth's surface.

Formula (4) was derived from water vapor absorption in six large bands of light with molecular scattering being disregarded.

Calculation of the weakening from one year to another of solar radiation by water vapor absorption in Shenyang showed a 21-year average of 0.319, which is 16.4 percent of the total quantity. Since 1974, a noticeable decrease has occurred in the amount of weakening due to water vapor absorption for an average value of about 90 percent.

(3) Weakening through scattering of rays and absorption by mixed pollutants (dust, air-soluble colloids, etc).

In the natural atmosphere, in addition to the weakening of solar radiation resulting from molecular and water vapor scattering and absorption, there is scattering and absorption by dust. We have termed mixed pollutants the combination of dust pollutants, ozone, carbon dioxide, and airborne particulates. Amount of weakening through the scattering of rays and absorption of mixed pollutants may be estimated using the following formula:

$$S_{\text{pollutants}} = S_o - S_{\text{extent}} - S_{\text{water}} - S_{\text{value}}. \quad (5)$$

Results of calculations show that weakening of the quantity of radiation has shown a general tendency toward increase over the years. In the Shenyang area, the average amount of weakening in 21 years has been 0.338, or 17.4 percent. From 0.22 calories/cm² in the late 1950's, it increased to 0.65 calories/cm², for an almost threefold increase in value. In 1976, in particular, it was even greater (0.647) or virtually one-third of the direct radiation from the sun. After 1977, the amount of weakening declined.

It is not difficult to see from Tables 4 and 5 that the extent of weakening by the three elements $S_{\text{molecules}}$, S_{water} , and $S_{\text{pollution}}$ results mostly from $S_{\text{pollution}}$. The most fundamental reason for the appearance of this phenomenon is the serious atmospheric pollution of cities by heavy industry.

Table 1. Extent of Weakening of Radiation Through Molecular Scattering (calories/cm² · units)

Year	58	59	60	61	62	63	64	65	66	67	68
Extent of weakening of radiation through molecular scattering	0.272	0.291	0.291	0.311	0.311	0.311	0.291	0.272	0.291	0.290	0.290
Percent of total	14.0	15.0	15.0	16.0	16.0	16.0	15.0	14.0	15.0	15.0	15.0

Year	69	70	71	72	73	74	75	76	77	78
Extent of weakening of radiation through molecular scattering	0.291	0.290	0.291	0.290	0.290	0.291	0.291	0.290	0.291	0.291
Percent of total	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0

Table 2. Extent of Weakening of Solar Radiation Through Absorption by Water Vapor (calories/cm² · units)

Year	58	59	60	61	62	63	64	65	66	67	68	69
Extent of absorption of solar radiation by water vapor	0.337	0.337	0.326	0.346	0.347	0.336	0.346	0.318	0.306	0.306	0.306	0.297
Percent of total	17.4	17.4	16.8	17.8	17.9	17.3	17.8	16.4	15.8	15.8	15.8	15.3

Year	70	71	72	73	74	75	76	77	78
Extent of absorption of solar radiation by water vapor	0.306	0.316	0.323	0.316	0.294	0.306	0.302	0.304	0.319
Percent of total	15.8	16.3	16.6	16.3	15.2	15.8	15.6	15.7	16.4

4. Laboratory Experiments on the Life of Catalysts

In order to test the long-term stability of the catalysts, mixed gases A were used in the laboratory to simulate actual production conditions (at a pressure of 16.5 kilograms/cm², a temperature of 650°C, air speed 110,000 hours⁻¹) with continuous revolving for 2000 hours. Results of the experiment (see Table 5) demonstrated that after 2000 hours no change occurred in the activity of the catalyst; the catalyst did not become brittle, nor crack, nor change color. Its tensile strength changed from 44.5 kilograms per square millimeter to 55.0 kilograms per square meter. Bending tests (rigid state at 90° with frequency of bending) remained at 9 times. This showed that the long-term stability of the catalysts was good.

IV. Rejuvenation of Catalyst

After the catalyst has been used for a certain length of time, its activity declines or is lost entirely. Reasons for this are complex, some of them being permanent toxification, partial corrosion, volatilizing of the active metal and loss of mechanical strength, all of which are irreversible. Temporary toxification and buildups of various substances may be reversed. Inasmuch as the catalyst has not lost its effectiveness, only the factors normally causing decline in activity had to be simulated in the laboratory with the activity of the catalyst being broken and experiments in rejuvenation explored, the results of which are shown in Table 6. (Waste catalyst powder made from the action of ethylene oxide and dust from the air were purposely painted on the surface of the catalysts. The catalysts were then placed in 850°C high temperatures under different airflow conditions and baked for long periods of time. Under conditions in which there was a lack of oxygen or at temperatures below the flash point, a mixture of gases caused carbon buildup. Active components were also purposely scraped away.)

The experiment demonstrated that by pinpointing the reversible factors causing a decline in the activity of the catalysts, rejuvenation could be done. Catalysts that had completely lost their effectiveness could be restored through replating with palladium and platinum by chemical reduction and heat treatment after which they could be used again.

V. Conclusions

The chemical reduction method of plating using a reduction solution made of sodium hydrogensulfite to prepare metallic catalysts for purifying exhaust gases was successful.

This new plating solution is easy to prepare; plating with it to desired thickness is easy; the carrier can pick up the quantity of active ingredients needed in a single step; the plating solution is fairly stable and may be used several times; and the quality of the plated layer is both quite well bonded and even. It is superior to the plating solutions used for the plating by reduction of catalysts reported in literature from outside of China.

Table 5. Catalyst Activity Before and After 2000 Hours of Life Testing

Temperature of tail gases (°C)		180	200	250	300	350	400	450	500	550	600	650
Rate of change under which samples were taken	Condi- tions											
Newly fabricated catalyst		86.6	89.0	91.5	93.5	95.0	96.5	98.5	99.4	99.6	99.7	99.9
After 1000 hours of use*		88.0	91.0	95.5	96.4	97.3	96.9	97.3	99.1	99.4	99.7	99.9
After 1700 hours of use		88.0	90.0	93.5	95.0	95.8	96.0	96.2	97.0	99.2	99.6	99.8
After 2000 hours of use		89.3	91.5	94.0	95.0	95.8	96.4	96.5	96.9	98.0	99.7	99.8
After 2 hours of 800°C impacting		89.3	91.6	93.5	95.1	95.8	94.5	96.6	97.8	97.9	99.9	99.9
After 2 hours of impacting double the gas volume		88.3	92.0	94.0	95.5	95.7	95.8	96.2	96.9	97.8	99.8	99.9

* After 1000 hours, 0.5 grams of specimen was removed for analysis.

* After 1000 hours, 0.5 grams of specimen was removed for analysis.

Table 6. Rejuvenation Experiment

Reason for decline in activity	Rejuvenation method	Initial Activity of Catalyst After Rejuvenation		Activity of Catalyst After Rejuvenation		Activity of Catalyst After Rejuvenation		Activity of Catalyst After Rejuvenation		Activity of Catalyst After Rejuvenation		Remarks
		t _{50%}	t _{90%}	t _{50%}	t _{90%}	t _{50%}	t _{90%}	t _{50%}	t _{90%}	t _{50%}	t _{90%}	
Dust pollution	Washed with 1 percent washing solution and dried	214	365	260	477	216	360					In the experi- ment, mixed gas A containing 10,000 ppm ethyl- ene was used at air speed of -1 28,000 hours and normal pres- sure to test activity.
High temperature baking	Reactivated in 450°C oxidizing atmosphere	190	420	342	590	190	410					
Carbon buildup	Bake off carbon for 24 hours in 500°C airflow Bake off carbon for 2 hours in 650°C airflow	290	393	370	560	300	398					
Erosion	Replate in plating solution as originally made up after ingredients washing in a 1 percent washing solution and drying	270	420	290	441	270	421					
		224	350	432	605	216	350					

Activity of the catalyst made in this new plating solution for the purification of exhaust gases was good (reaction temperatures were low, and the purification rate was as high as 99.9 percent so that the SP-2305E gaseous state chromatograph could not detect impurities). Stability at high temperatures was good (withstanding 900°C temperatures, withstanding revolving for a long period of time at 650°C, and withstanding multiple fluctuations of temperatures from high to low.) Mechanical strength was high (withstanding abrasion, withstanding shock, resisting impact from large volume of gas with tensile strength and bending test frequency being unaltered after 2000 hours). Chemical stability was good (with no rusting in the 120 salt mist experiment, resistant to water vapor, to sulfur dioxide, and to dichloromethane with little effect on activity). Methods of preparation and equipment were simple and easy to use. The catalysts can be rejuvenated. Suitable for large scale industrial purification of exhaust gases, and additionally for the recovery of the energy in the exhaust gases for use in waste heat boilers to produce steam or to turn waste gas turbines to generate electricity. From both a technological and economic standpoint, it is sensible and workable.

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SOURCES OF URBAN INDUSTRIAL POLLUTION SURVEYED

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pp 46-49

[Article by Wang Xinyuan [3769 2450 0337], Shijiazhuang Institute of Agricultural Modernization, Chinese Academy of Sciences, and Nie Guisheng [5119 2710 3932], Beijing Municipal Institute of Environmental Science and Protection Science: "Comprehensive Assessment of Urban Industrial Pollution"]

[Text] Study of the sources of urban industrial pollution lies at the heart of any investigation of regional environmental pollution and any assessment of environmental quality. This article undertakes a preliminary exploration of pollution in the southeastern suburbs of the capital using the methods of comprehensive assessment of sources of urban industrial pollution and pollutants.

1. Principles of Comprehensive Assessment of Sources of Pollution and Selection of Parameters

There are three major aspects to principles for the comprehensive assessment of the sources of industrial pollution and pollutants: (1) The ways in which pollutants are discharged into the environment; (2) the absolute quantity of pollutants discharged; and (3) the potential damage or effects produced on the environmental system, with a comparison of the various pollutants and various sources of pollution in all three aspects.

The following three ways and means may be used to obtain the absolute amount of various pollutants discharged: (1) The balance of materials: a study of the entire technological production process from raw materials to finished products to calculate the absolute quantity of gas, water, and waste materials discharged. (2) Internal plant monitoring data: full use of monitoring data already existing within the plant, calculating the absolute quantity of various pollutants released at discharge points from each workshop or from the plant as a whole. (3) On-site measurements: In industrial plants that discharge large quantities of the three wastes [waste gas, waste water, and industrial residue] but where monitoring data is lacking, direct measurements may be taken with continuous analysis of samples during the normal hours of plant production.

In order to be able to compare different sources of pollution and different pollutants, similar yardsticks and similar standards must be used. Sanitary standards may be used for gas and water, but no uniform standards have been found as yet for residues; all that can be done is provide a body of figures from experiences about their toxicity and their effect on the environment in place of standards to perform an assessment. In the selection of standards, it is necessary to take into consideration various series of standards that reflect the major aspects of the damage that sources of pollution may create in the environment of a region, and it is necessary as well to include insofar as possible the indices of pollution for a local area in the selection of a series of standards, including at least more than 80 percent of the pollutants; otherwise they will not be representative.

II. Assessment Methods and Formulas Used for Sources of Pollution and Pollutants

In order to determine in a comprehensive way the major sources of pollution and the major pollutants, we propose use of the method of a pollution rate index. The pollution rate index method uses the absolute quantity of pollutants discharged as its parameters, and selects assessment standards in accordance with different objectives. Following standardized calculations, numerical values are finally used to express the relative importance of sources of pollution and pollutants. Though the pollution rate indices are mutually comparable relative figures, in the computation process, basic consideration is given to the three aspects of absolute quantity of discharge of pollutants, the effects on the environment of pollutants, and the relative proportions. The basic formulations for calculation are as follows:

$$P_{il} = \frac{m_i}{C_{li}} \quad (1)$$

$$P_{il} = \sum_{i=1}^n \frac{m_{ij}}{C_{li}} \quad (2)$$

$$R_{il} = K \left(P_{il} / \sum_{i=1}^n P_{il} \right) \quad (3)$$

$$R_{il} = K \left(P_{il} / \sum_{i=1}^n P_{il} \right) \quad (4)$$

$$R_{\text{overall}} = \alpha R_{\text{gas}} + \beta R_{\text{water}} + \gamma R_{\text{residue}} \quad (5)$$

In the formula, the i in m_i is the absolute quantity of pollutants discharged (tons per year); the i in C_{li} is the threshold concentration of pollutants according to the l standard series (milligrams per liter or milligrams per cubic meter); the l in P_{il} is the quantity of pollutants in the standard series

(cubic meters per year); in P_{ijt} , the i is the quantity of discharge from pollution sources in the equiscalar series (cubic meters per year); the l in R_{il} is the l pollutant rate index in the standard series; the l in R_{ijt} is the rate index for a certain source of pollution in the standard series; $R_{overall}$ means the overall pollution rate index for waste gases, waste water, and waste residues for a certain source of pollution; i is the pollutant type series; j is the pollutant source series (industrial plants etc); l is the standard series selected; α , β and γ represent gas, water, and residue weighted coefficients respectively; and K is the rate coefficient with $K = 100$.

III. Comparison and Uses of Assessment Methods

In the assessment of environmental quality in Beijing's western suburbs, a method was put forward for assessment of the sources of pollution using an index for discharged poisons whose standardized formula for making calculations is

$$F = \frac{m_i}{d_i}.$$

In this formula, the i of F_i is the released toxin index for the pollutants; the i of m_i is the quantity of pollutants released; and the i in d_i is the assessment standard for the pollutants.

The assessment standard d_i is the toxicity standard of i pollutants. The threshold dose for chronic toxic effect was used to determine the d_i value, and the following calculations were made for waste water and waste gases:

Waste water: d_i = the threshold dose (milligrams per kilogram) of i pollutants for chronic toxic effects \times the body weight (55 kilograms) of an adult;

Waste gas: d_i = the threshold dose (milligrams per cubic meter) of i pollutants for chronic toxic effects \times the volume of air (10 cubic meters) breathed by a person each day.

The comparison of the pollution rate index method and the western suburbs toxin discharge index method discussed above are identical in conception. The objective for both is to make a comparison to determine the major sources of pollution and the major pollutants. The difference lies in the selection of standards. In the western suburbs, threshold dose was used; we have used threshold concentration. Consequently, the concept of F_i and P_{ijt} values are clearly not the same. The F_i value is a pollution index (in which man is the standard to show the absolute amount of certain pollutants discharged within a certain period of time. If the full effect is on human bodies, a chronic toxic effect will be produced in some people). In actual fact it is also a kind of relative potential toxic capability that supposes no natural purification ability and a toxic capability in the competing or cooperating action of pollutants. The standard used in the rate index method is the threshold concentration. Thus, P_{ijt} is an equiscalar quantity of discharge concept, i.e. a diluted magnitude of value (water or gas) when pollutants are diluted to a standard concentration value and expressed in volume units. The main advantage is the assessment of pollutants may be conducted in accordance with many aspects of the same objective without being

limited to the effects on human health, and the selection of standards it provides may be numerous. Consequently, large quantities of pollutants may be calculated and assessed while the indices provided for selection by threshold dosage are very few. In addition, in the western suburbs formula, when the denominator is multiplied times a number or is eliminated, there is no effect on the mutual comparisons. The western suburbs method of calculation discovered only 10-odd standards, while in waste water alone from the southeastern suburb, there were more than 100 kinds of pollutants. Use of the western suburb method would make assessment difficult to conduct. However, it provides many criteria as assessment standards for threshold concentrations. In addition to some standards formulated inside China, a large quantity of material is available outside China for reference. The surface water standards set by the Soviet Union in 1975, for example, contain 378 different pollutants, and standards set in the United States in 1973 for threshold concentrations in workshops include more than 400 different pollutants. The rate index method not only can compare the main sources of pollution by waste gas, waste water and waste residues, but it also permits a comprehensive comparison of the many factors of waste gas, waste water, and waste residue from every individual plant and the health of employees.

In an official study of water system and water source protection, an assessment of sources of pollution for polluted water introduced the concept of equiscalar pollutant load (P_1). The formula used for this calculation is as follows:

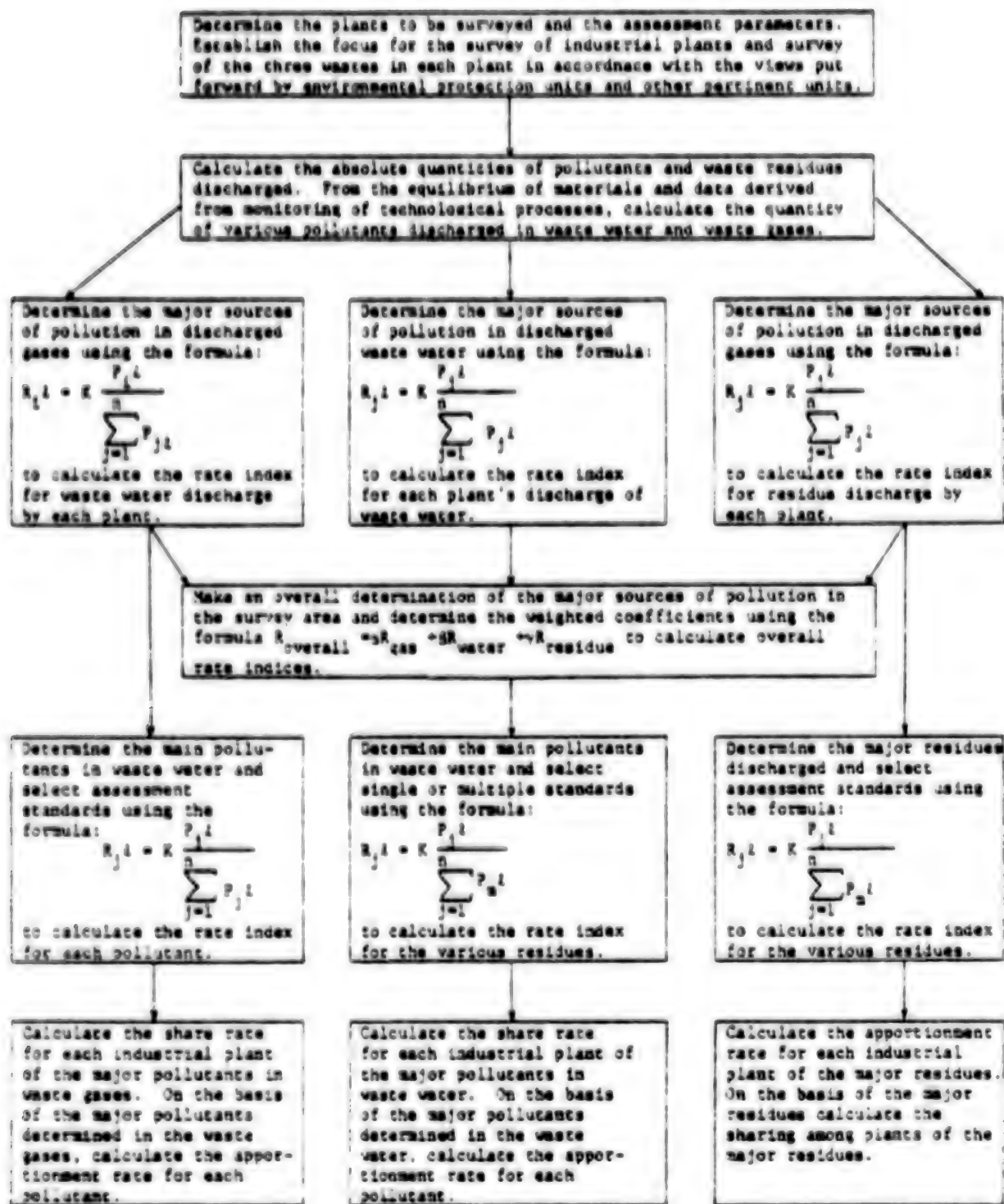
$$P_1 = \frac{C_1}{[C_{01}]} Q_1 10^{-4}$$

In the formula Q_1 means the volume of water containing a given pollutant (tons per day or tons per year); C_1 means tested concentrations of a given pollutant (milligrams per liter); $[C_{01}]$ means absolute value of the industrial discharge standard for any given pollutant.

The rate index method and the above formula are virtually identical because concentration and the product of the quantity of water are absolute quantities of any given pollutant discharged. The only difference is that the above formula uses absolute value as the standard and results are in weight units, while the standards used in the rate index contain units, and this is a difference from the official method. Additionally, in the assessment of sources of urban pollution, one cannot simply use a single key element in waste water to determine the main sources of pollution. It is necessary as well to consider numerous key elements in waste gas and waste residue. It was in response to these requirements that the rate index calculations were proposed.

IV. Comprehensive Assessment Programming and Examples of Calculations for Sources of Industrial Pollution

Programming of the assessment of sources of industrial pollution is as shown in the following diagram:



Program Diagram for Assessment of Urban Industrial Pollutants

Using the assessment programming and methods depicted in the diagram, a programmed assessment (programmed results survey) was conducted on 80 different kinds of pollutants in more than 100 industrial plants in the southeastern suburbs of Beijing. A brief explanation using the programming shown in the diagram follows.

1. Determine the major pollution of waste gases discharged. In calculations for the waste gases, the above basic formulas (2) and (4) were used. Threshold concentrations (milligrams per cubic meter) of air pollutants for workshops in the United States for 1973 were selected for use as assessment standards (C18). In the formula, m_{1j} represented the absolute quantity of j pollutants discharged (tons per year) in gas from any given plant. Results of calculations were used to determine the major sources of pollution in gases discharged by four plants: (1) electric power plant (64.85, rate index, further later); (2) chemical testing plant (12.42); (3) coking plant (8.95); and (4) asphalt felt plant (4.82).

2. Determine the major sources of pollution in waste water. Inasmuch as five series of standards of toxicity, sensory organs, hygiene, biochemistry, and pollution of irrigation could be selected, five sets of results could be obtained for the major sources of pollution and the major pollutants in waste water. Additionally, overall indicators could also be used trying two methods. The first was overall average indicators, i.e. taking the mathematical average value of five indicators. The second was overall minimum criteria, i.e. taking the smallest number among five indicators. The major source of pollution as determined by the overall average criteria was the coking plant (21.92), a paper making plant (18.91), the No 2 Chemical Plant (12.95), and the No 3 Chemical Plant (9.36).

3. Determine the major sources of pollution in residues discharged. In view of the toxicity of residues and their potential for creating harm to the environment, consideration was given at the same time to ways to solve the problem. The 34 industrial residues figured out for this area were divided into 5 kinds and each was assigned an empirically weighted coefficient to represent the assessment standard in conducting assessment. These five kinds were: toxic residues (0.1), harmful residues (2); residues with considerable effect on the environment (4); residues with some effect on the environment (10); residues with no major effect on the environment (100). As a result of calculations, it was determined that the main sources of pollution were a ferroalloy plant (21.97), a local chemical plant (14.74), No 1 Pesticide Plant (12.02) and No 2 Chemical Plant (11.32).

4. Overall determination of the major sources of pollution. Using basic formula (5) given above, weighted coefficients α (0.45), β (0.35), and γ (0.20) for gas, water, and residue respectively were determined using the extent of the effects of water, gas, and residue on the environment of the area and their location in the area. As a result of calculations, the major sources of overall pollution were determined to be an electric power plant (29.93), a coking plant (11.63), a chemical testing plant (6.98), No 2 Chemical Plant (6.93), and a paper manufacturing plant (6.66).

5. Determine major pollutants in waste gases. The above formulas (1) and (3) were used with assessment being undertaken on the basis of the individual criteria of toxicity, sensory organs, hygiene, biochemistry, and irrigation pollution. The major pollutants as determined by overall average criteria were phenols, chlorines, heavy metals, oils and inorganic salts.

The rate of apportionment among industrial plants of the major pollutants. The so-called apportionment rate among industrial plants for major pollutants means the percentage of the total amount of pollutants discharged that any given plant discharges. The major pollutant discharged by every plant in the southeastern suburbs was dust, with a total quantity of 76,000 tons per year being discharged by a total of six plants. Of these, the apportionment rate for the electric power plant was 88.5 percent, for the coking plant 6.1 percent, and for the ferroalloys plant 4 percent. Thus, it was possible to clearly point out the target plants for control of the discharge of dust.

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PEOPLE'S REPUBLIC OF CHINA

BRIEFS

WATER TREATMENT PLANT OPENS--Changchun, 8 Mar (XINHUA)--The initial stage of China's largest wastewater treatment plant in the Jilin chemical industrial center, northeast China, has been put into operation recently, according to a plant spokesman. The initial function of the plant is to treat wastewater discharged by chemical plants and residential districts with a population of more than 50,000. Current treatment capacity is 100,000 tons per day. The plant ultimately will handle double that amount. The plant, under construction since March 1979, is equipped with wastewater monitoring stations, neutralizing lagoons and a 65-kilometer long pipeline which conveys water from chemical plants and residential districts to the plant and then into the Songhua River and the Mangniu River. In the past few years, however, industrial waste containing 192 harmful chemicals has badly polluted the river water, soil and crops, bringing protests from local people. In compliance with a nationwide pollution control program chemical plants in the Jilin center, one of China's leading chemical producers, have set up an environmental protection office staffed by 450 pollution control specialists. The central government has allocated 60 million yuan for building the Jilin treatment plant. [Text] [OW080230 Beijing XINHUA in English 0202 GMT 8 Mar 81]

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OVERVIEW OF AREA'S POLLUTION PROBLEMS

Islamabad THE MUSLIM in English 21 Feb 81 p 5

[Article by Nestor Cervantes]

[Text]

ALMOST forgotten amidst the turmoil of the Middle East is an equally serious threat to the development of the region: Pollution.

Since the outbreak of hostilities between Iran and Iraq last September, many refineries and oil installations have been severely damaged or destroyed. Pollution problems in the war zone are likely to have worsened.

But even before the Iran-Iraq war, scientists and government officials from eight countries surrounding the Persian Gulf were scheduled to meet last October. Because of the war, the meeting was postponed. However, the problem they were to discuss will still be there when the conflict is over: the environment of one of the world's most endangered seas.

Common to eight States (Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates), the Persian Gulf sea is the centre of the fastest developing area in the world. It is also one of the most fragile ecosystems in the world.

The surrounding countries of the Gulf are telescoping into 10-15 years the industrial development of a century. Their population growth is also among the fastest in the world, intensifying environmental pressures.

A team of United Nations Environment Programme (UNEP) consultants visiting the Gulf in 1976 concluded that if the existing rate of industrial and urban growth continued to produce the same level of uncontrolled waste, the Gulf environment could soon be damaged beyond recovery.

The Gulf has one major natural resource: oil. Petrodollars and the fear of the eventual exhaustion of oil reserves have led to a fast diversification of industry.

Already in existence or planned for the Gulf coast are 22 petroleum refineries, 20 petrochemical complexes, 2 plastic plants, 16 natural gas liquefaction plants, 11 cement plants and 8 fertiliser plants, 3 shipyards / dry docks, 8 new ports, 26 desalination and power plants, 4 steel mills, 5 pipe and steel products plants, 8 aluminium smelters, 1 titanium mill and 2 copper refineries, 1 tyre factory and 2 sugar refineries.

The new industries may cause increasing air pollution—fluorides, sulphur dioxide, iron oxide, hydrocarbons, cement dust. A UNEP team in 1976 found that the most hazardous emissions to the coasts are chemical effluent from industry, organic pollution from fish-packing and meat-packing industries, and untreated urban sewage from new housing settlements often occupied before any sewage facilities are built.

FRESH WATER

The Gulf has the world's greatest concentration of desalination plants, 26 of them already turning out 138 million gallons of fresh water a day. At least another 22 are on order for the coasts, which will double the area's desalination capacity to 275 million gallons a day. The discharges from these plants make the Gulf's inshore waters more saline.

In general, pollution emission controls are absent from Gulf countries and there are no adequate arrangements for disposal of industrial waste. Gulf oilfields, for instance, produce natural gas with a high sulphur content. Most of this gas is flared or burned to waste in the open air and emitting sulphur dioxide.

Saudi Arabia's coastal city complex of Dhahran, Dammam and Khobar receives over 2 million tons of sulphur dioxide a year from gas flared at nearby oilfields—73 per cent of the area's total sulphur dioxide pollution.

The most common source of hydrocarbons and carbon monoxide in Gulf States is the ever-increasing level of traffic. Automobiles in Kuwait increased from 175,526 to 439,553 between 1972 and 1978. Traffic is Qatar's main air pollution source while in the United Arab Emirates, it accounts for over 90 per cent of carbon monoxide emissions.

A significant and often overlooked pollutant is dirty motor oil from gas stations. As oil is readily and cheaply available, there is no economic incentive to recycle it. For instance, 1,000 tons of motor oil is discharged by Oman per year and 28,000 tons by Kuwait. The motor oil is discharged into the ground, the sewage system or into the sea.

The biggest danger of marine pollution comes offshore. Around 100 oil tankers pass every day through the Straits of Hormuz to load oil at Gulf terminals. Some 60 per cent of all the oil carried by ships anywhere in the world is loaded in the Gulf. But there is less public awareness of the flow of oil from tanker ships into the ocean in

deballasting and tank washing.

Empty tankers on their way to load up with oil cannot travel completely empty. They would float too high, bob like corks and are difficult to steer. To gain weight, they half fill their tanks with water. Before loading up with oil, ballast water is discharged. This is never clean because of leftover oil from the previous load.

Saudi Arabia's waters could receive nearly 400,000 tons of oil a year from deballasting. This is 150 times more than the estimated 2,737 tons of oil effluent discharged directly from the Saudi Ras Tanura refinery, one of the largest in the world.

ACTION PLAN

Since 1976, Gulf States have been working to save the area from pollution and ensure safe, sustainable development, mostly through the "Kuwait Action Plan." The plan was originally proposed by UNEP. It is, after the Mediterranean, the second of UNEP's regional seas programme to get moving.

The action plan has four main goals: a detailed assessment of the Gulf environment; guidelines for future development; legislation to protect the region and develop it sustainably; and supporting measures like the strengthening of national and regional institutions.

The eight Gulf States, for instance, pledged to take joint action over marine emergencies: ship collisions, drilling blow-outs or industrial accidents which could result in large oil discharges into the sea. A regional trust fund of \$ 5.8 million has also been created,

of which over half has already been handed to UNEP.

Already, 17 projects are under way. These include assessment of oil pollution and other pollutants, identification of new industrial developments which have a major environmental impact, forming contingency plans for industrial and shipping accidents and looking at ways of fighting pollution through regionally-coordinated port and transport development.

The next meeting of government experts was originally planned for late October last year but has now been postponed indefinitely. That meeting would have decided which Action Plan project should be implemented using the \$ 5.8 million trust fund. Since then, UNEP has held informal consultations with participating governments which have extended the mandate of the Kuwait-based Action Plan Secretariat.

But time is vital to the threatened Gulf which may take a lesson on sustainable development from the ancient city of Siraf on the Gulf's northeastern shore, in present-day Iran.

In the 9th and 10th centuries A.D. Siraf extended four kilometres along the coast and supported about 30,000 people. It was an important cultural and trade centre from the Mediterranean to China. In the 12th century A.D. it suddenly declined and disappeared.

Nobody knows why: its ruins were only rediscovered this century. It is clear that the meagre natural resources of the coastal strip could not have supported a city of Siraf's size. It depended entirely on trade and when trade faltered, Siraf died. — The Muslim-Depthnews Service.

UNIVERSITY TEACHERS DISCUSS MARINE POLLUTION

Dar es Salaam SUNDAY NEWS in English 8 Feb 81 p 5

[Interview with Hamisi Saidi Kibola and Boniface Mwaiseje, members of the Dar es Salaam University teaching staff, by Wilson Kaigarula; date and place not given]

[Text] Q. To what extent do you think the Tanzania environment has been tampered with by pollution?

NDUGU KIBOLA: The main concern at present is marine pollution. The Tanzania coastline is polluted from three main sources.

The first is pollution from the high seas, for the East African coastline of which Tanzania forms a part, is close to the tanker routes to and from the Persian Gulf.

Oil carrying ships from the Gulf initially pose no problem. The problem arises on their way back, after unloading the cargo. The ships are filled with water for stabilisation as they sail. The water is discharged when the ships approach their destinations. The water swept to the western Indian Ocean by equatorial currents thus has traits of oil.

Secondly, pollution occurs within the territorial sea of Tanzania, such as the recent one at the Dar es Salaam Harbour.

The third is land-based pollution and is occasioned mainly by industries located at the coast. These discharge pollutants that flow into streams and eventually to the sea.

NDUGU MWAISEJE: Pollution which is sudden, like the recent one at the Dar es Salaam Harbour, hits headlines. This, however, is not of major concern. What matters more is persistent pollution.

After closure of the Suez Canal in 1967, more ships started using the Cape (South Africa) Route, whereby ships pass just outside the East African coastline. As the ships wash-out water to prepare for fresh loading of oil, they pollute the sea.

A study conducted in 1971/72 by the then East African Marine Fisheries Research Organisation showed that in the southern shore of Mafia Island, there were 1,350 grammes of tar balls in every 100 square yards. At Kizimkazi, on the southern tip of Zanzibar Island, there were 1,650 grammes per 100 square yards.

Q: Could you cite some effects of marine pollution?

NDUGU KIBOLA: Some of the effects are obvious, such as the fish killed in the wake of the recent spill at the Dar es Salaam Harbour. Another effect is damages to the coastline, partly manifest in tar-coated stones along beaches.

Some of the effects are not obvious. Marine pollution may affect the ecology of the sea, through, say, destroying breeding places of fish. This could also change the size of fish. The effect could be passed on to consumers who may eat contaminated fish.

NDUGU MWAISEJE: Some of the effects are catastrophic, like the one at the Maimbazi Creek where an oil slick led to eruption of a fire in January last year.

This was publicised apparently because it happened near Dar es Salaam. There could be similar cases in, say, Pangani (Tanga) that pass unnoticed.

In the recent oil spill at the Dar es Salaam Harbour, the obvious effect was death of much fish. [as published] Some of the victims like hydrozoans are however not easily noticeable. These form an important component in the food system of marine life.

Very little research has, however, been done in the tropical environment (as opposed to the temperate system) to determine the effects of persistent pollution.

Q: What legal antipollution safeguards are in force? Are these sufficiently stringent and scrupulously enforced to curb the problem?

NDUGU KIBOLA: Protection of marine life forms one-third of present initiatives to complete an international convention on the Law of the Sea. One of the spheres covered in the draft convention is that national jurisdiction would, expectedly, cover 12 miles of territorial sea.

Under the arrangement, Tanzania is empowered to enact laws and promulgate regulations to curtail marine pollution. So far, this has been done by the Merchant Shipping Act which should, however, both be vigorously enforced and its penalties reviewed.

A spill like the recent one would cost the ship owner only 10,000/-. This could legitimise such pollution, for after paying the money, he is left to go. He can thus decide to include 10,000/- in his cost of operation and care less if he will do it again.

Furthermore, there is no control of pollution from land-based sources in Tanzania. This is an area in which zoologists and lawyers ought to sit together and map out a strategy to act as a basis for an anti-pollution policy in the country.

NDUGU MWAISEJE: The law is very loose and needs thorough review. Heavier fines must be imposed upon culprits. The present 10,000/- is an amount that major shipping and oil companies can very easily settle, and perpetually at that.

The amount is moreover highly disproportionate to the losses resulting from the effects of pollution. An oil spill that kills much fish consequently jeopardizes the fortunes of fishermen and their families.

Fish is in addition a major source of protein. Its depletion could thus create a nutritional imbalance. Surely, the value of these effects is not equivalent to only 10,000/-!

Q: How serious do you consider the problem of undisposed refuse to be?

NDUGU KIBOLA: The problem is related to rapid urbanisation. The dissolution of local authorities some years ago created an unpleasant situation in terms of disposal of refuse. Now that they have been re-instituted, they should work out a good scheme of ensuring that within controllable limits, refuse is disposed of, as it poses very big risks to life.

NDUGU MWAISEJE: The problem is quite serious. There is no waste disposal programme, particularly relating to waste water. In Dar es Salaam, for instance, waste is dumped in Kijitonyama stream, and finally ends up at Maasani Beach, which is thus polluted.

The sewage pipe at Ocean Road Beach is broken, so that sewage spreads out on the shore, and nobody seems to care about repairing it.

None of the industries in Dar es Salaam has an efficient water treatment system--water is simply poured in to the nearest stream. It is essential to have treatment plants to cover even people. In tropical environment, we don't need expensive methods. The simplest and cheapest ideal for small communities could be oxidation ponds.

Q: Has air and noise pollution reached a stage that warrants concern?

NDUGU MWAISEJE: For a country like Tanzania, to control pollution from vehicle exhausts is very difficult because we don't make the vehicles. But we could do something about vehicles that are excessively smoky through the sheer mischief or carelessness of their owners.

Air pollution is on the whole a minor problem restricted to urban centres. The few complaints I have heard of relate to people living in the neighbourhood of the Tanga Fertiliser Company and the Wazo Hill Cement Factory in Dar es Salaam.

As regards noise, we are still safe, but should be careful that the situation doesn't get out of hand. Being a relatively new country, we have a chance to learn from the mistakes of the developed world. Indeed, the problem out there is so big that in the United States, for instance, anti-pollution is an industry in itself.

Q: In the light of present and potential problems, would you consider formation of a national environmental agency pertinent?

NDUGU KIBOLA: It is not only in Tanzania that the protection of the environment has been delayed. On the part of the developed countries of the West, environment became an explosive field only in the late 60s mainly because of the effects of industrialisation and activities related to it.

In Tanzania, it is only now, in the early 80s, that environment is becoming an area of increasing concern. At the moment, the University of Dar es Salaam has sponsored research on industrial pollution and its effects on the Tanzania environment.

There have also been vigorous efforts to protect wildlife mainly because of depletion of important species like rhinoceros, elephants and cheetahs. There is also the on-going afforestation campaign. All these are important factors in a trend which I think is discernible...that we are becoming increasingly mindful about our environment.

In different countries, environmental coordinating agencies have been formed. It is not yet late for Tanzania. So far, there have been scattered initiatives in dealing with the environment.

The Bureau of Standards is dealing with industrial pollution, the Ministry of Natural Resources and Tourism is dealing with wildlife and forests; the Ministry of Lands, Housing and Urban Development is handling town planning. A central organ will be useful in coordinating all these activities.

NDUGU MWAISEJE: We badly need a central environmental agency. It is necessary to both change our attitude towards the environment, and incorporate it in our planning, particularly of projects.

Take the Songo Songo Project. Have we thought of safeguards in the event of a major accident? We also have not thought of how to curb problems that would arise if oil was found there. For this would affect marine life as well as the Mafia Channel that holds the best potential for the fishing industry in the country.

Among other tasks, the agency could help to seek better pollution control methods than those presently applied, which are not very effective, and some of which are outdated.

Serious attention would also be addressed to importation of pollution. Rich nations find it cheap and convenient to set up industries in the Third World where pollution-related laws are weak. For in developed countries, pollution fines are very heavy.

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WORK ON AIR POLLUTION STANDARDS DESCRIBED

Moscow STANDARTY I KACHESTVO in Russian No 1, Jan 81 signed to press 22 Dec 80
pp 21-23

[Article by L. I. Vitkovskaya, candidate of technical sciences; Z. A. Yakushina, T. V. Kosygina and N. I. Panchenko, engineers, All-Union Scientific Research Institute of Standardization: "On Work for Standardization in the Area of Protection of the Atmosphere"]

[Text] The protection of nature and efficient utilization of natural resources under the conditions of rapid development of industry, transportation and agriculture, and the utilization of an ever increasing quantity of natural resources constitute of the most important economic and social problems of the Soviet State.

According to data of the Main Geophysical Observatory, the main sources of air pollution in the cities and industrial centers are thermal electric power stations, ferrous and nonferrous metallurgy enterprises, and the petroleum processing, chemical, coal, construction, wood processing and pulp and paper industries.

Automotive transportation has become increasingly significant as a source of pollution of the atmosphere of cities in recent years. The production of motor vehicles in the USSR is increasing at rapid rates, which can lead to a further increase of the concentration of harmful substances in the atmosphere.

An analysis of materials concerning pollutants in the atmosphere showed that in many of the cities of our country there is a high overall level of air pollution caused by the high contents of dust, carbon monoxide, sulfur dioxide, nitrogen oxides and several other specific substances all at the same time.

According to data of the Sumy branch of the Khar'kov Polytechnical Institute, the losses for the national economy resulting pollution of the atmosphere with discharges from industrial enterprises is increasing from year to year, and in 1980 they amounted to more than 12 billion rubles. This is why in the accountability report of the CPSU Central Committee to the 25th Party Congress, General Secretary of the CPSU Central Committee, Chairman of the Presidium of the USSR Supreme Soviet, Comrade L.I. Brezhnev and the directive document adopted by the 25th congress, "Main Direction for the Development of the National Economy in 1976-1980," considered questions of environmental protection, including protection of the atmosphere and improvement of the utilization of natural resources, to be among the main tasks of the Tenth Five-Year Plan.

The decree of the CPSU Central Committee and the USSR Council of Ministers, "On Stepping up the Protection of Nature and Improving the Utilization of Natural Resources," instructed the State Committee for Standards, "... to envision, beginning in 1973, in the plans for state standardization, the development of complexes of general technical state standards for the protection of nature and efficient utilization of natural resources."

Under the current five-year plan the work for standardization in the area of the protection of nature is being conducted on the basis of the aforementioned decree of the CPSU Central Committee and the USSR Council of Ministers in keeping with the program of work for 1976-1980, in which it was planned to "develop a complex of scientific and technical measures for maximum prevention of the negative influences of economic activity on the surrounding environment," and the program of work of the state five-year plan for the development of the USSR national economy during 1976-1980, under the section entitled "The System of Standards in the Area of the Protection of Nature."

Within the framework of this assignment, at the present time the following have been developed:

"Methods of Evaluating the Effects of Atmospheric Pollution on the Living Conditions and Health of the Population" (Methodological recommendations), which make it possible to establish quantitative expression of the patterns of change in the condition of the health of the population under the effects of atmospheric pollution, and also to utilize these results for substantiating prophylactic and therapeutic measures, and evaluating their effectiveness;

"The Maximum Permissible Concentrations of Pollutants (Dust, Hydrocarbons, Nitrogen Oxides, Carbon Monoxide and Sulfur Dioxide) in the Atmospheric Air of Various Climatic Zones."

As a result of the research that has been conducted, amounts have been proposed for the maximum permissible content of nitrogen dioxide, carbon monoxide and dust in the atmospheric air, and these are differentiated according to time. In the future these data will be used for developing standards;

"Methods of Determining the Benzpyrene Content in Exhaust Fumes of Internal Combustion Engines." As a result of this research, methods were developed for determining benzpyrene using spectral-fluorescent analysis, on which the Shpol'sky method is based. The methods were introduced at the Vladimir Tractor Plant and at the present they are being used for developing a state standard with a similar name;

"Normative-Technical Documentation for Methods of Analysis and Purification of the Atmosphere When It Is Polluted by Substances in Industrial Discharges." As a result of research that was conducted, they have developed: OST 26-14-1623--77, Gas Purification and Dust Removal Equipment. Terms and Definitions. With this standard it is possible to systematize and establish equivalent terms for gas purification and dust removal equipment; RTM 25-17-07--77 "Electric Filters. The Method of Determining the Proportional Resistance of Dust." This method ensures the possibility of reproducing and comparing results obtained by various researchers in our country and abroad; RD RTM 26-14-10--78, "Methods of Investigating the Physico-Chemical Properties of Industrial Dust." This material unifies methods of examining dust; norms

and methods for determining the content of harmful substances in exhausts from gasoline and diesel trucks and buses (at manufacturing plants and in operation).

To estimate the toxicity of gasoline and diesel engines of trucks and buses, a thirteen-stage cycle has been proposed for testing at the motor station (instead of the five-stage one under OST 37.001.070--75). This increases the precision of the results of the estimates of the toxicity. On the basis of these methods, one can determine the actual discharges of toxic substances with exhaust fumes from gasoline and diesel engines, and establish the maximum permissible norms for discharges of carbon monoxide, methane and nitrogen oxides with exhaust fumes from gasoline and diesel engines. The norms start with 01.01.80.

On the basis of scientific research work conducted in preceding years by collectives of many scientific research and planning institutes, by now seven state standards for the protection of nature have been developed and approved for the complex for atmospheric protection (see table).

GOST 17.2.3.01--77 establishes general rules for control of pollution of the air with harmful substances, requirements for hygienic evaluation of the harmful effects of polluted industrial and transportation discharges into the atmospheric air on the health of the population and sanitary-domestic conditions for their life, and also requirements for a description of the distribution of fields of concentration of impurities throughout the city, and an evaluation of the dependency between the amount of concentration and meteorological conditions. The standard contains general provisions that describe the organizational bases of the observation and control service, the basic principles for the organization of control, a classification (types) of observation points, rules for the selection of places for stationary and flare observations, and instructions regarding the density (quantity) of stationary, mobile and flare posts (depending on the number of residents and the topography of the locality). It establishes programs and time periods for observations at stationary posts (complete, incomplete, reduced), depending on the harmful substances in the air, the regions of the location of the control posts, and meteorological conditions.

GOST 17.2.3.02--78 regulates the rules for establishing and controlling permissible discharges of harmful substances by industrial enterprises, taking into account the latest scientific-technical achievements and hygienic, economic and ecological requirements. It establishes the criteria for the quality of the atmospheric air, the policies for establishing PDB's and VSV's, and also the policy for controlling their observation. Permissible discharges of harmful substances are calculated using methods that are substantiated theoretically and experimentally.

The standard applies to industrial enterprises, thermal electric power stations and other facilities that are planned, being reconstructed or in operation, regardless of their departmental jurisdiction.

GOST 17.2.2.03--77 applies to cargo, passenger and special motor vehicles and buses with gasoline engines with a mass of more than 400 kilograms. It determines the permissible content of carbon monoxide in the exhaust pipe of a motor vehicle at a depth of 300 millimeters when it is idling with two frequencies of the revolution of the engine's crankshaft: minimum and 0.6 nominal.

Table:

<u>Number of Standard</u>	<u>Title</u>	<u>Date of Introduction</u>
GOST 17.2.1.01--76	Protection of nature. The atmosphere. Classification of discharges according to composition.	01.01.77
GOST 16.2.1.02--76	Protection of nature. The atmosphere. Discharge of harmful substances by motor vehicles, tractors and engines. Terms and definitions.	01.01.77
GOST 17.2.1.04--77	Protection of nature. The atmosphere. Content of carbon monoxide in exhaust fumes of motor vehicles with gasoline engines. Norms and methods of determination.	01.07.78
GOST 17.2.3.01--77	Protection of nature. The atmosphere. Rules for control of the quality of the air of population points.	01.01.79
GOST 17.2.3.02--78	Protection of nature. The atmosphere. Rules for establishing permissible discharges of harmful substances by industrial enterprises.	01.01.80
GOST 17.2.4.01--79	Protection of nature. The atmosphere. Method of determining the amount of drop removal after use of wet dust purification equipment.	01.07.81
GOST 17.2.6.01--80	Protection of nature. The atmosphere. Instruments for taking samples of the air of population points. General technical specifications.	01.01.81

The standard envisions a gradual (year by year) toughening of the norms for the discharge of carbon monoxide. These types of machines are inspected in the capital cities, health resort cities and cities with a population of more than 300,000 during technical servicing (TO-2), repair and technical inspection GAI, at service stations for private motor vehicles, and at automotive repair enterprises when the vehicles are released.

GOST 17.2.6.01--80 applies to instruments for collecting air samples from population points for laboratory analysis and establishes general technical requirements for aspirators that are used for observation and control of the quality of the air in population points.

Domestic work experience in standardization in the area of protecting the atmosphere has made it possible to reveal certain difficulties and shortcomings. First of all one should take note of the need to change over to comprehensive standardization, using the program-target method.

As distinct from existing practice, the programs for comprehensive standardization should envision a complex of measures for creating scientifically substantiated normative-technical documents, scientific research work for substantiating standards in this area, reduction of losses in the national economy as a result of prompt introduction of measures for the protection of nature, and increased effectiveness of capital investments used for the protection of nature.

In the future it will be necessary to plan the development of a system of programs for comprehensive standardization in the area of protection of the atmosphere which stipulates the development of the following normative-technical documents:

General requirements for evaluating the condition of the atmosphere and for its protection;

Normatives for the content of harmful substances in the atmosphere and in discharges;

General requirements for methods and means of controlling air pollution and the content of discharges, and also methods and means for controlling content of harmful substances in the atmosphere and in discharges;

Rules for protection of the atmosphere from the pollution with harmful substances discharged by industrial, domestic and agricultural sources of pollution, means of transportation and self-propelled agricultural machinery;

Methods of purifying discharges of harmful substances;

Methods of calculating discharges of harmful substances from industrial and transportation sources of pollution;

Rules for air intake for production purposes;

Rules for developing predictions of the condition of the atmosphere;

Methods of evaluating the economic effect of the introduction of standards in the area of protection of the atmosphere;

Methods of controlling the quality of the atmosphere;

Rules for singling out regions with specific conditions concerning the state of the atmosphere;

Methods of utilizing and destroying wastes from enterprises of various branches of the national economy.

The importance of the work for standardization in the area of protection of the atmosphere is confirmed by the USSR Constitution, the decree of the CPSU Central Committee and the USSR Council of Ministers, "On Additional Measures for Stepping Up

The Protection of Nature and Improving the Utilization of Natural Resources," and the law concerning protection of the atmospheric air, which states: "the atmospheric air is one of the main vitally important elements of the natural environment."

The Soviet state attaches great importance to protection, restoration and improvement of the condition of the atmospheric air in order to provide the best conditions for the life of the Soviet people.

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BOOK ON USE OF PESTICIDES REVIEWED

Kishinev SEL'SKOYE KHOZYAYSTVO MOLDAVII in Russian No 11, 1980 p 57

[Review by G. Merenyuk, chief of the laboratory of soil microbiology of the division of microbiology of the Moldavian SSR Academy of Sciences, of the book "Primeneniye pestitsidov i okhrana okruzhayushchey sredy" by K. K. Vrochinskiy and V. N. Makovskiy, Izdatel'stvo "Vishcha shkola, Kiev]

[Text] At the present time and in the future pesticides will occupy a leading position in the fight against pests, diseases and weeds in agriculture. Their assortment and production volume increase from year to year. On the other hand, pesticides, as biologically active substances, present a potential danger for the biosphere.

Until recently there was no referent guidance which could elucidate the biological-typogenic regulations for the application of pesticides in the USSR from the standpoint of the protection of the biosphere. Therefore the publication of the reference aid of K. K. Vrochinskiy and V. N. Makovskiy, "The Application of Pesticides and the Protection of the Environment," which elucidates the principal questions of the strategy and tactics for protection of the biosphere with the utilization of pesticides, will be of a great deal of assistance to scientists, agronomists and all agricultural specialists.

The introduction and the first chapter give information about the damage from pests, diseases and weeds, the volume of application of pesticides, the state system for testing and selecting pesticide preparations in the USSR, and a toxicological-hygienic description of the main groups of pesticides.

The next three chapters deal with questions of the stability, migration, accumulation and detoxification of pesticides in the main three objects of the environment: the soil, bodies of water and the atmospheric air. Each chapter lays out the basic preventive measures (improvement of forms and methods of application of pesticides, the establishment of differentiated zones for sanitary protection, and so forth). Prognostication and evaluation of the real danger of the application of pesticides are presented from modern ecological standpoints.

The final, fifth chapter is devoted to further improvement of selection and control of their application in the USSR. The eight appendices give forms and extracts from state documents concerning regulation.

On the whole the book deserves a high rating, and large amount of domestic and positive foreign material concerning the protection of the biosphere from pollution has been utilized in it.

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SWEDISH ENVIRONMENT GROUP AGAINST DANISH POWER PLANT

Stockholm DAGENS NYHETER in Swedish 25 Jan 81 p 6

[Text] The Swedish Nature Conservation Agency has decided to appeal plans for a new thermal power plant in Copenhagen. The agency feels the much too liberal conditions for the facility will lead to large emissions of sulfur and nitric oxides in southern Sweden.

The Amager plant in Copenhagen today consists of two blocks. Now a third is planned that can be heated with both coal and oil. When the Nature Conservation Agency spoke out on the plan last year it pointed to the serious increase in acidity in Swedish lakes and requested that emissions of sulfur and nitric oxides be limited to the extent economically and technically possible.

The Copenhagen City Council has now established the conditions for the new plant. The council will permit more emission than the power company had suggested itself.

The company asked permission to release 20,000 tons of sulfur dioxide a year. The City Council would allow 35,000 tons. The Nature Conservation Agency thinks the limit should be set at 6000 tons.

The agency is now appealing the decision with reference to the environmental protection convention which states among other things that countries should "endeavor to limit and as much as possible reduce and restrict air pollution."

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ANAEROBIC DEPOLLUTION PROCESS PRODUCES METHANE

Paris L'USINE NOUVELLE in French 5 Feb 81 p 74

[Article by Daniel Kerel: "A Promising Depollution Alternative: The Anaerobic Method"]

[Text] The purification of waste products from the agriculture and food industries is now technically feasible economically by the anaerobic method, using the sludge blanket process. Conclusions are drawn from two operational cycles of a 200 cubic meter reactor in a Dutch sugar processing plant.

Up to now, the only really convincing achievements in the area of methane fermentation on an industrial scale could be found only in purification plants downstream from the anaerobic step and with the objective of stabilizing the sludge produced.

In the last few years, the researchers' attention has turned toward this process with the objective of applying it not only to sludge stabilization, but also to the purification of all types of waste products. As compared to anaerobic purification, this process has the dual advantage of providing savings in expensive energy (electrical energy for aeration), and of generating a by-product with high energy content (methane). But whereas this type of operation is relatively well under control in the case of solutions with a high content in dry matter and suspended solids, it is quite different in the case of wastes whose pollution content is in the dissolved state.

Professor Georg Lettings of Wageningen University (Netherlands), who developed the process used for treating residual water at the Dutch CSM sugar factory at Halfweg which uses a 200 cubic meter anaerobic reactor operating on the "Upflow Anaerobic Sludge Blanket" (UASB) principle, demonstrated during the European Inter-University Session, organized at Dijon in December by the European Council, that obstacles have now been overcome.

This reactor, which has been tested in two successive production cycles, performs extremely well in the areas of purification and gas production. In particular, this process reduces by 90 percent the oxygen requirements of the waste materials being treated. The oxygen requirement is converted into methane usable as fuel. This result was obtained by performing the digestion with very short hydraulic holding times (3 to 6 hours) and infinitely long dissolved matter holding times. This "quasi-filtering" maintains the very high concentration in dry matter and active anaerobic sludge required within the tank.

To reach this objective, use was made of an upflow bacterial bed where an ascending column of mostly dissolved fermentable substrates meets a methane-producing biomass. The methane-producing biomass is maintained within the digester as a result of exceptional flocculation characteristics and a high sedimentation velocity. Moreover, the upper section of the reactor was designed specifically for the clarification of the mixed digestion liquid (sludge plus liquid), and creates favorable conditions for the generation and proliferation of the sludge with such remarkable properties. A conical gas hood plays the role of gas-solid separator by routing particulates in the next lower section where the solid-liquid decantation takes place. The greatest part of the sludge then meets the "fluidized" bed within which the biodegradable matter is digested. The main originality of this technique lies in the possibility of obtaining granules (or flakes) of sludge that can be easily decanted and consist of an agglomerate of solids and bacteria.

Methane Production of 270 Cubic Meters Per Day for a Total Throughput of 50,000 Liters/Hour

As far as production management is concerned, the key to successful and effective operation of this system lies in the adjustment of the various digestion parameters (temperature, pH, nitrogen, calcium, and phosphorus concentrations, volume load). The sludge, which is best created from waste materials rich in biodegradable components with a dissolved chemical oxygen requirement varying between 1000 and 3000 milligrams/liter, is difficult to obtain and the start-up phase must be carried out with extreme care. Eight to 12 weeks are required to create an effective bed and reach a steady state. Once the bed is created, the volume loads may be increased up to a chemical oxygen requirement of 6 kg per cubic meter per day at 25°C (15 kg per cubic meter per day at 35°C) and a daily gas production of up to 270 cubic meters with a throughput of 50,000 liters/hour can be obtained. The process is controlled automatically through continuous measurement of the pH, of the gas production, and of its composition. Although many precautions must be taken to insure that optimum conditions are maintained (absence of toxic substances, constant pH of about 7, etc.), the sludge produced at Halfweg can be adapted to the variation of some parameters. Because of this capability, the technique offers the possibility of treating waste water at the exit temperature from the plant (25 to 35°C). The need for a heating system is thus avoided. Moreover, the circulation of the gas produced is sufficient in this specific case to insure adequate stirring in the tank, thus avoiding the need for a mechanical system. The construction of the system is then simple and cheap (about Fr600 per cubic meter for an average size).

The Halfweg experiment has also underlined the possibility of storing the sludge between production cycles (the sludge remaining in a stopped digester maintains sufficient activity to be able to start up again in less than 10 hours). Everything is not perfect, however. The initial start-up of the system is still excessively long (8 to 12 weeks), sensitivity to toxic substances (CH_3 , Cl, CCl_4 , CN-) is very high, and finally, this technique remains a pre-treatment process, since the water still cannot be fed back into the environment as is. Additional simple treatments are necessary, but in spite of these difficulties, purification using this method results in depollution costs reduced twofold (fivefold if the gas produced is used).

The Halfweg results are considered to be so promising that the Americans have begun construction of a 4,000 cubic meter concrete digester.

GOVERNMENT OFFICIALS ANNOUNCE ANTIPOLLUTION MEASURES

Athens I KATHIMERINI in Greek 6 Feb 81 pp 1, 3

[Text] The public Power Corporation [DEI] plant at Keratsini as well as the industries in the Attiki area will be using an improved quality of mazut (crude oil), a fact which will burden the [Attiki] basin inhabitants by 5 billion drachmas annually (through an increase in the price of electricity and in the produced industrial products). This was announced by Minister of Industry and Energy St. Manos as the first measure designed to limit pollution in the area of Athens although in his view the problem is primarily caused "by the large number of cars, traffic irregularities, and poor maintenance of car engines." By contrast, the Technical Chamber of Greece, in evaluating the pollution sources, referred to the industries and the DEI plant as the primary [cause] and then cited the cars and the central heating of apartment and other buildings.

At the same time, as stated by Minister of Social Services K. Doxiadis, the government is moving forward, taking decisive measures to limit pollution. The announcement of these measures will be made collectively by the agencies which are responsible for the environment: the National Council for the Environment [ESP] (Ministry of Coordination) and the Ministries of Zoning and Environment, Industry, Transportation, and Social Services. Doxiadis and Deputy Minister Ath. Tsoukandas added that "efforts are being made to protect health from the pollution of the environment."

Yesterday's Pollution

Tsoukandas made public the data on pollution collected yesterday by the Environmental Pollution Monitoring Service [YEP] of the Ministry of Social Services. The pollution, as indicated below, was reduced even further:

Smoke: In the 2400-0300 3-hour period we had 1.64 units of smoke from the Patisia plant, 1.27 from the Aristotelous plant, 0.27 in Piraeus, and 0.80 in Rendis. In the 0300-0600 3-hour period, 1.06 units in Patisia, 0.82 at the ministry, 1.50 in Piraeus, and 1.54 units in Rendis. In the 0600-0900 3-hour period, 4.53 units in Patisia, 3.53 at the ministry, 3.61 in Piraeus, and 3.65 in Rendis. On Wednesday during the period from 0600 to 0900 hours the levels of smoke were: 5.42 in Patisia, 2.94 at the ministry, 2.32 in Piraeus, and 3.51 in Rendis.

The major source of pollution from smoke is the automobile because the increase is registered between 0600 and 0900 hours, that is, during the peak traffic hours.

Sulfur Dioxide: The sulfur dioxide and nitrogen levels were also low. The average level during the 24-hour period for sulfur was 83 micrograms in Patisia, 89 at the ministry, 109 in Piraeus and 66 in Randis. The levels for nitrogen were 172 micrograms between 0800 and 0900 hours, 227 between 0900 and 1000 hours, and 225 between 1000 and 1100 hours.

DEI Plant

Minister of Industry and Energy St. Manos stated yesterday that efforts are being made to buy improved quality mazut which will be mixed with crude oil from other sources to produce burning oil with low content in sulfur to improve the quality of oil used by the DEI plant in Keratsini and the industries in Attiki.

This type of oil to be used by the industries in Attiki and the DEI Keratsini plant will cost 20 percent more, a fact which will result in higher costs and consequently higher prices for products produced by the industries in the Athens-Piraeus region. It also will result in higher DEI rates. The increased cost due to the purchase of cleaner crude oil (the most likely countries of supply are Algeria, Britian--North Sea--and Nigeria) for the production of improved fuel will be, according to the minister of industry and energy, approximately 100,000 dollars (or 5 billion drachmas annually). Note by translator: Obviously one of the two figures is incorrect; 100,000 dollars equals 5 million, not 5 billion drachmas.⁷ The major burden of the increased cost of the improved fuel will be reflected in the DEI rates since DEI is the major consumer--600,000 tons of mazut annually.

Manos added that the Ministry of Industry and Energy is moving rapidly to procure the necessary quantities of improved crude oil for the production of the better quality fuel. On the other hand, the minister noted that because of the increased cost of the products to be produced by the industries in the Attiki basin and due to the higher fuel costs, the production of the industries in other parts of the country will be comparatively less costly and this, according to Manos, will strengthen the provincial industries.

The minister noted also that he considers the large number of cars, the irregular traffic conditions, and the poor maintenance of car engines significant pollutants of the capital.

Regarding the surveillance and control of the central heating installations, Manos said that such control is difficult because it requires a large number of inspectors. He also said that in his opinion, the pollution in the capital is due primarily to the large quantities of gasoline used by automobiles, secondly to the oil (used by industries) and thirdly to diesel oil (used by central heating installations).

The Technical Chamber of Greece in a statement yesterday concerning the "cloud" [smog] of atmospheric pollution underlines that it considers the measures for solving the pollution problem taken by the appropriate state authorities as inadequate. The sources of pollution in the Athens area--the statement says--are the industrial activities, the use of fuel by the industries, the DEI plant in Keratsini, automobile traffic, and central heating installations.

It is also underlined that in certain pollutants such as the floating solids the largest part comes from industry--something like 95 percent--while in others such as carbon monoxide the decisive part is played by automobile traffic.

The Technical Chamber of Greece, noting the need to deal with the pollution problem in a comprehensive way, proposes the formation of a new agency with overall jurisdiction over the protection of the environment, as well as the adoption of the following measures:

1. To draft a specific program for controlling atmospheric pollution in the Athens area.
2. To organize a sound and comprehensive network to check pollution also in areas bordering on industrial zones for a genuine appraisal of the effect the industries have and for an evaluation of all the necessary parameters.
3. To gather systematic data concerning the meteorological conditions in a given area to be able to forecast the more likely days in which a pollution "cloud" might appear.
4. To undertake an epidemiological study of the effects of pollution.
5. To take immediate measures whenever the "cloud" appears by banning automobile traffic and closing industries before it forms.

At the same time, the Technical Chamber of Greece proposes certain essential measures which must start immediately such as:

- a. The construction of a subway (metro) and beltways for rapid traffic, and so forth.
- b. The electrification of public transportation and its reorganization on a sound basis.
- c. The transfer of at least some categories of industries outside the Attiki basin.
- d. The checking of the proper operation of automobile engines on the basis of pollution control devices.
- e. The monitoring of industrial emissions on the basis of emission limits which must be established.

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BUDGET CUTTING ENDS SUPPORT FOR ENVIRONMENT GROUPS

Stockholm DAGENS NYHETER in Swedish 13 Feb 81 p 9

[Article by Dick Ljungberg]

[Text] There will be no government bill this spring for regular state aid for the environmental movement. Work is being done on a bill in Karl Boo's (Center) Municipal Affairs Ministry but Liberals and Conservatives will not go along with new automatic outlays in the current economic situation.

Environmental and conservation groups now get so-called project subsidies from the Ministry of Agriculture. Such funds must be applied for in each individual case. The intention of the new proposal--advertised for the end of February--was to insure the organizations of some central funding each year.

In 1979 Riksdag member Gunnar Bjork (Center) recommended a central fund for organizations concerned mainly with the environment and nature conservation. Under his proposal those receiving funds would have to have at least 1500 members and have active local branches in at least half the county council districts in the country. Active meant they must schedule at least 25 meetings a year.

People's Campaign?

Under these criteria the following organizations would have been entitled to such aid in 1979: Future in Our Hands, Friends of the Earth, the Environmental League, MIGRI (National League of Environmental Protection Groups), the Joint Organization to Save the Rivers, the National League of Local Farms, the Swedish Environmental Protection Society and the League of Allotment Gardeners.

Today the People's Campaign Against Nuclear Power might also be entitled to funds but that depends on which criteria one selects. This would also affect the costs. A half million kronor a year has been mentioned but that would include the present project subsidies from the Agricultural Ministry.

According to Bjork's proposal each organization would receive a basic subsidy of 25,000 kronor and a sliding subsidy of 12 kronor per member per year. But that was in 1979 currency.

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LARGEST ENVIRONMENTAL DAMAGE CASE SOON IN COURT

Stockholm DAGENS NYHETER in Swedish 5 Feb 81 p 10

[Article by Bo Engzell]

[Text] Landskrona, 4 Feb--Spreading dangerous poisons in a reckless way so they presented a general danger to the health of many people is the most serious charge in the biggest environmental scandal to be brought to court in Sweden so far. It will come up before the district court in Landskrona within the next few weeks.

The case involves the nationally-known BT Chemicals plant in Teckomatorp where tons of poison have also been buried. The clean-up alone will cost Swedish taxpayers 40 million kronor! One of the pieces of evidence to be presented by county prosecutor Lennart Eliasson will be the autopsy report on a deceased BT Chemicals plant manager. His liver and kidneys contained high levels of poison which probably came from the factory.

The autopsy results have just become available.

"The autopsy report will be introduced to show that the BT Chemicals operation was dangerous," said district prosecutor Eliasson.

It was the county prosecutor who asked the autopsy on the deceased plant manager to be performed by experts. The man died of cancer. Professor Christoffer Rappe of Umea along with U.S. and Swiss experts found that the man's liver and kidneys contained elevated levels of various dioxins and dibenzofuranes. They probably are the result of previous exposure to chlorinated phenols, Professor Rappe stated.

Traces of the so-called Seveso poisons were also found in the body. A very large tumor was found in the liver. Among other things BT Chemicals produces phenoxy acid. Many claim that the acid causes cancer.

The activities of BT Chemicals have led to a giant case in the Landskrona district court. Five people have been indicted. Some 40 witnesses and plaintiffs have been summoned. It is expected to last 7 weeks.

At the last minute a dispute has broken out between the prosecution and the defense concerning the expert summoned by county prosecutor Eliasson. The defense wants another "neutral" expert. This part of the indictment may not be dealt with until the very end of the trial.

In general those charged have denied the charges. The main defendant is the executive director of BT Chemicals. Among other things he has denied knowing that tons of very dangerous poisons were buried on the factory grounds, an area it will take years to clean up. It is the removal and permanent storage or incineration of these poisons that will cost the state, i.e. the taxpayers, around 40 million kronor.

Risk Long Prison Sentences

Several of the charges in the indictment against the director of BT Chemicals could lead to long prison sentences if the court finds them to be valid.

With regard to the spreading of poison, a serious violation according to the county prosecutor, the executive director should have seen that this posed a general danger to the health of many people. The factory, which has since been blown up, lay close to the population center of Teckomatorp. The factory produced poisons of the phenoxy acid type and chlorinated phenoxy acids were spread through inadequate or defective air cleaning equipment. Spreading poison in this way involves a danger to human health, especially with regard to air passages, mucous membranes and eyes. Water polluted with phenoxy acid was released into seeping ponds and poisoned the soil in the vicinity, the indictment also charges.

Serious Violation

County prosecutor Eliasson regards the violations as serious. This took place over a long period of time, people were exposed to danger. BT Chemicals has tried to conceal its activities and to mislead the public and control bodies and the cost of cleaning up has been an enormous burden on society.

Secondly, the county prosecutor has charged that operations were conducted with gross negligence.

There was large-scale smuggling of goods, i.e. the shipment of environmentally-hazardous waste to Denmark without the permission of the Environmental Protection Agency with the help of fictitious invoices that indicated ordinary goods shipments and this is another charge against the director. He is also accused of fraud and serious tax fraud. As executive director of BT Chemicals he reported profits that were too low (2.5 million kronor) for the firm on 3 annual declarations, according to the indictment.

Visits to Inn and Presents

Another charge against the director involves loans and gifts. Charges have also been made against the recipient, a division director of the Poison Control

Board that approves various control substances. The division director never repaid a loan for 3000 kronor. It was later recorded as a "fee" from BT Chemicals. He was also given presents and invited out to inns on several occasions.

A director of BT Chemicals' parent company in Denmark has been accused of assisting in the smuggling of goods on a large scale. This refers to the export of the environmentally-hazardous waste from Sweden to Denmark.

A former chairman of the Health Board in Svalovs community who handled things for BT Chemicals for a number of years has been charged with accepting inappropriate payment in the form of 200 liters of herbicide of a type prohibited for aerial spraying.

Sold Illegal Chemical Controls

The fifth person indicted in the case is a sales leader with BT Chemicals. He sold chemical controls that were not registered with and approved by the Product Control Board.

Over the years quite a few people in Teckomatorp have claimed that they suffered from allergies, cancer or other illnesses which they and experts in quite a few cases believe stem from contact with the poisonous discharge from BT Chemicals. No injury claims have been filed as yet, however. Perhaps there will be several now that the autopsy of the deceased plant manager has shown that his body contained high levels of poisons which presumably came from the factory.

The BT Chemicals mess can continue for several years before we come to the bottom of the environmental scandal.

In the present circumstances a letter from the BT Chemicals director to the co-indicted director of the parent company in Denmark has a bizarre effect. The letter speaks of the "idiots on the county council and the Environmental Protection Agency" who charged that BT Chemicals conducted a business that was hazardous to the environment without permits or tests. He said the county council should publicly retract the charges. Otherwise they should be charged with dereliction of duty in a complaint to the judicial ombudsman.

The letter and a stack of interrogation notes are part of the thick files of evidence to be presented by the prosecutor in the mammoth case.

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CONFERENCE DISCUSSES USE OF PESTICIDES, CHEMICALS IN FARMING

Stockholm DAGENS NYHETER in Swedish 29 Jan 81 p 7

[Text] Uppsala--TT [PRESS WIRE SERVICE, INC.]--The poisons used in agriculture are often used inappropriately and carelessly. There is inadequate knowledge of the risks in using herbicides and pesticides. Warning notices are ignored.

This appeared when this year's plant life protection conference began Wednesday at the Ultuna Agricultural University. The theme was protection of farm workers. The Occupational Inspection Agency and the Worker Protection Agency sharply criticized present conditions with regard to handling poisons.

Between 4000 and 5000 tons of chemical control substances are used in agriculture each year. This is considerably more than is used in forestry where the annual usage is around 200 tons.

"The substances used in agriculture include a substantial number that are highly poisonous," said office director Thomas Lindqvist of the Worker Protection Agency.

In addition to better training Lindqvist pointed to the need for a safer job environment in the form of the required handling routines and application methods. Warning labels must also be improved. The present ones are hard to read and worded in a complicated fashion.

"The knowledge of the risks involved in control chemicals is often amazingly poor," said occupational inspector Hans Lindgren of Uppsala.

Professor Vilhelm Umaerus of the Agricultural University stressed the importance of not using larger quantities than necessary in control measures. It should also be possible to reduce the need for control applications through preventive measures and better cultivation techniques.

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SWEDEN

BRIEFS

CARBON DIOXIDE DANGER--The unknown amount of carbon dioxide in the atmosphere could be a global threat to the environment. Sweden should take the lead and refrain from increasing energy use and from creating new energy systems that depend on coal and oil according to the Swedish Conservation Society. The society is one of the participants in an international seminar on the carbon dioxide problem that will start on Monday in Stockholm. The society thinks Sweden should stress the issue. Researchers have shown with computer models that it will probably be two degrees warmer on earth if carbon dioxide quantities in the atmosphere double within 50 years. That is enough to disrupt the world's climate. It could be necessary to stop using coal and oil for that reason. It is estimated that world consumption of fossil fuels will double every 16 years. By restraining the consumption of these fuels we can gain some extra time in the view of the Conservation Society. [Text] [Stockholm DAGENS NYHETER in Swedish 8 Feb 81 p 12] 6578

NEW ENVIRONMENT PROTECTION MEASURE--Starting 1 July 1981 the Concession Board for Environmental Protection and county councils should review applications concerning the establishment of operations that could disturb the environment. The Environmental Protection Agency should not continue to have this kind of responsibility but should concentrate instead on exercising central supervision and representing environmental protection interests in such cases. This was proposed by Agricultural Minister Anders Dahlgren (Center) in a bill. [Text] [Stockholm DAGENS NYHETER in Swedish 12 Feb 81 p 6] 6578

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